Vol. XVI. March, 1899. No. 3.

PAVING SEWERAGE

MUNICIPAL ENGINEERING

WATERWORKS PARKS

A MONTHLY MAGAZINE.

DEVOTED TO THE IMPROVEMENT OF CITIES.

GOOD ROADS, STREET CONSTRUCTION,
CLEANING AND LIGHTING,
SANITATION,
BRIDGES.

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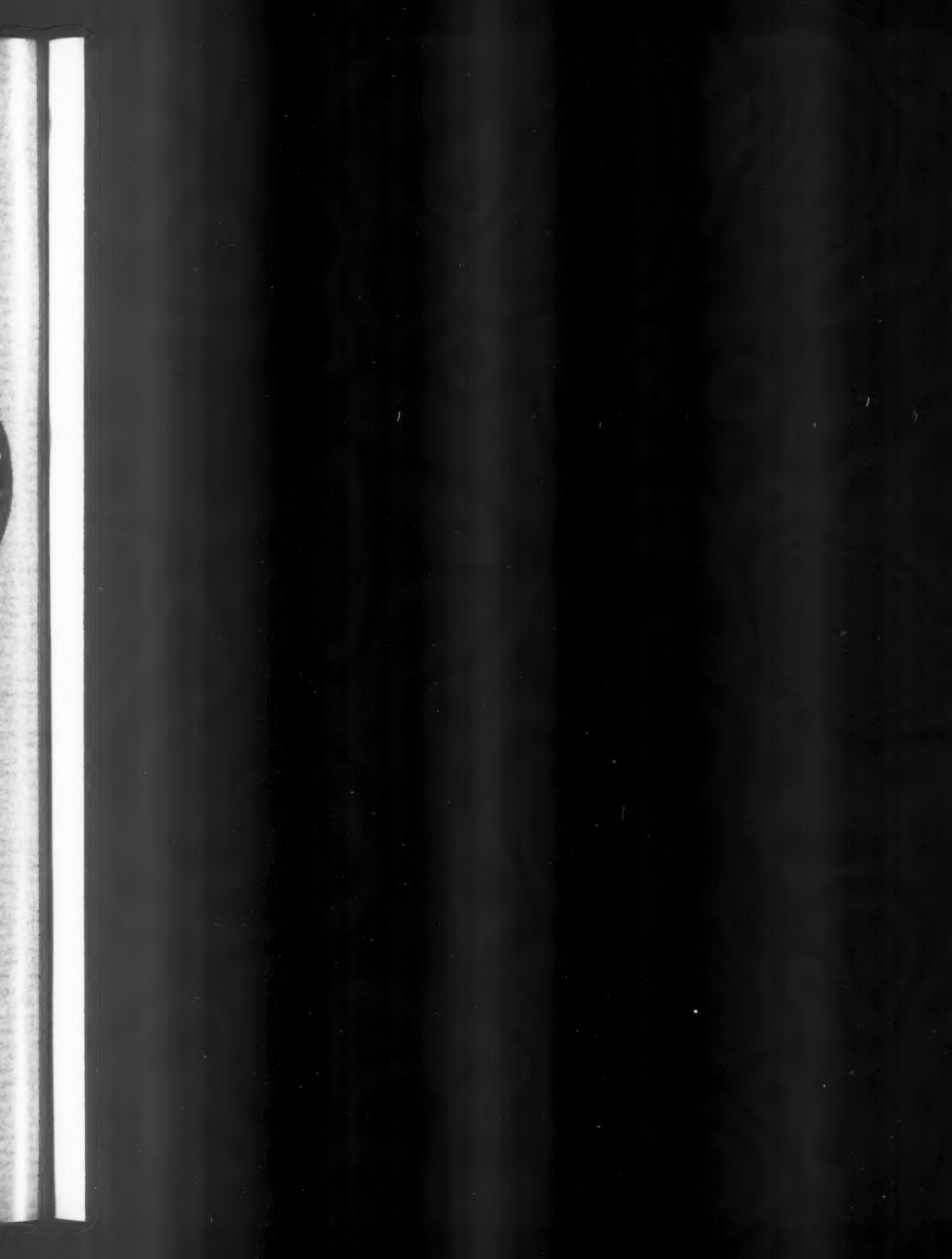

Municipal Engineering

VOLUME XVI. MARCH, EIGHTEEN NINETY-NINE. NUMBER 3.

SOME DETAILS OF STREET RAILWAY CONSTRUCTION.*

By W. H. Rosencrans, City Engineer of South Bend, Ind.

The subject of street-railway construction is a constantly broadening one, and, in my opinion, will soon overshadow in importance that of the steam railroad. I wish to speak of a few details of street-railway construction, and in doing so will describe briefly the street railway systems and interurban railroad lines in and about South Bend, Ind. The city proper has at present about eight miles of street railroad, all of which was rebuilt in the summer of 1898.

Outside of the city there is a line running along the brow of the St. Joseph river bank, in a southeasterly direction to Mishawaka, a distance of four miles, its present terminus being in the center of the town. There is another line which leaves South Bend on the east and runs in a direct route to Mishawaka, on the north side of the river. Both roads follow the highway the entire distance, but are constructed on the sides of the road wherever it is possible to do so.

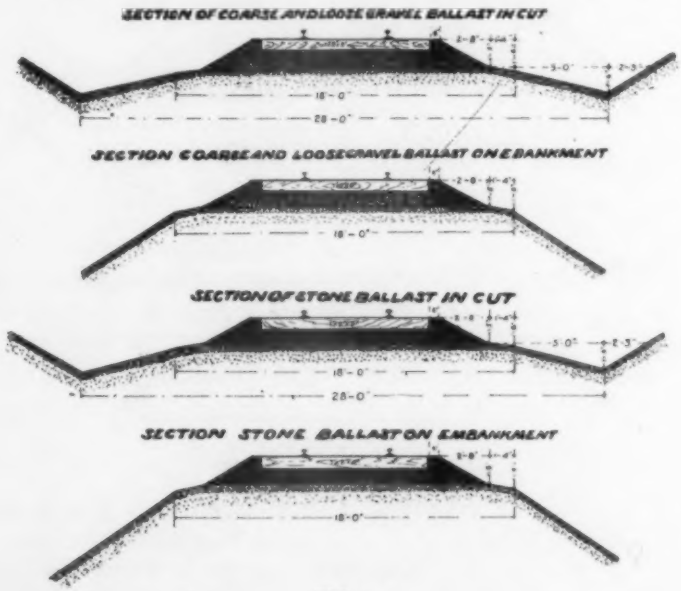
SECTION OF COARSE AND LOOSE GRAVEL BALLAST IN CUT
SECTION COARSE AND LOOSE GRAVEL BALLAST ON EMBANKMENT
SECTION OF STONE BALLAST IN CUT
SECTION STONE BALLAST ON EMBANKMENT

FIG. 1.

The same company has also acquired the Elkhart street railroad and the Goshen street railroad, and during November and December, 1898, connected these lines by a ten-mile interurban line along the

*Read before the Illinois Society of Engineers at the annual meeting in January, 1899.

Lake Shore and Michigan Southern Railroad right of way nearly the entire distance, on private right of way.

A line is located between Elkhart and Mishawaka, a distance of ten miles, and will be constructed early this coming spring, together with many extensions to other towns in the vicinity of South Bend.

The city lines were constructed, with the exception of curves, entirely of T rails, weighing seventy pounds to the lineal yard of the high girder rail form, furnished by the Johnson Steel Company, using section No. 70–264. All rail used was sixty feet in length. The old lines of South Bend were first torn up and all old material removed. Then the street was excavated a sufficient depth below sub-grade to allow the placing of one foot of gravel below the base of ties, and excavated to a width of eight feet. This sub-grade was rolled thoroughly with a five-ton steam roller, having a compression of five hundred pounds per square inch. The track was then laid in the prepared trench, the rails, ties and splice bars having been previously distributed along the gutters. The gravel ballast was then distributed along the line and the lining and grading of the track was done in a most painstaking manner, using bar and pick tamps to give the finishing touches. The track was brought to exact line and grade. The spaces between the ties were then thoroughly tamped with hand tamps until the gravel was brought to an even hard surface and at the level of the base of the ties. Great care was required in the construction and putting together of the joints. Thirty-six-inch splice bars were used, having drillings for three bolts in each rail. The splices were all sent to the shops of the company and all iron coatings, rust

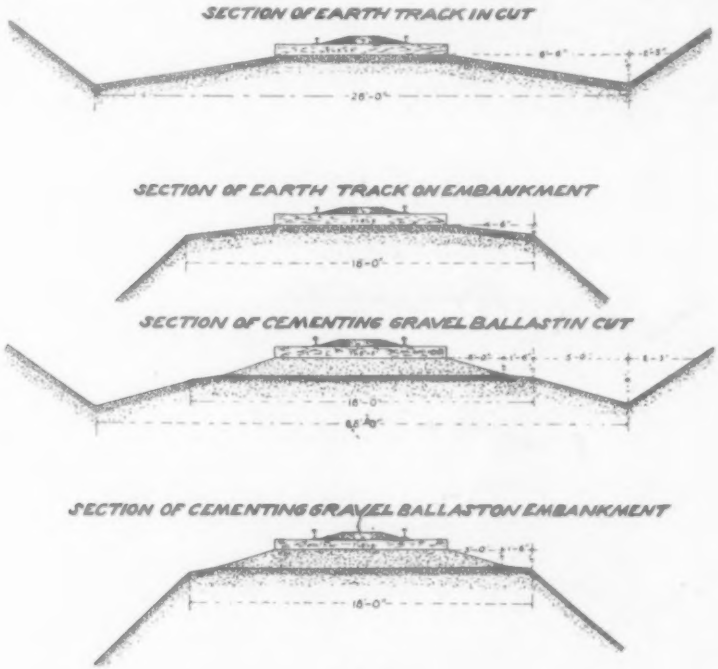
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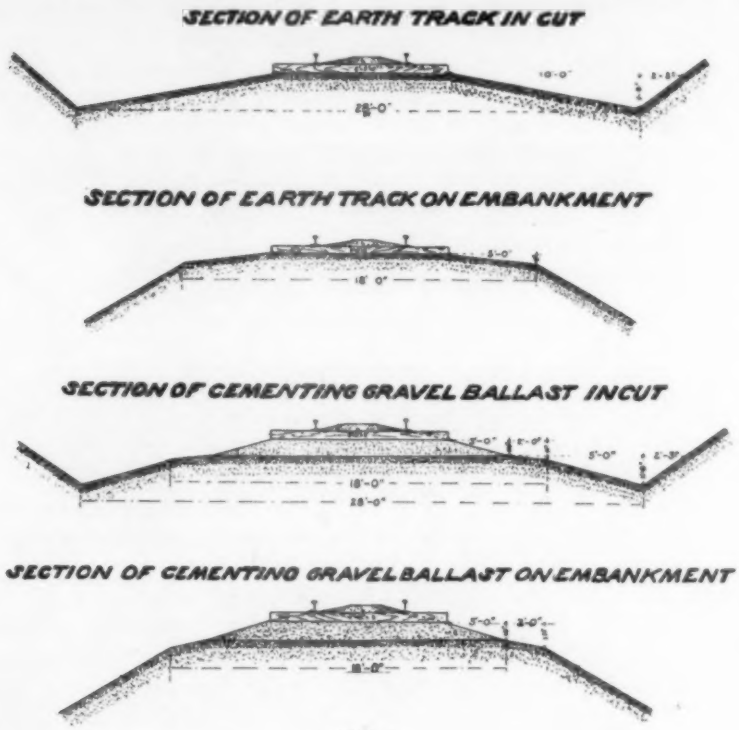
FIG. 2.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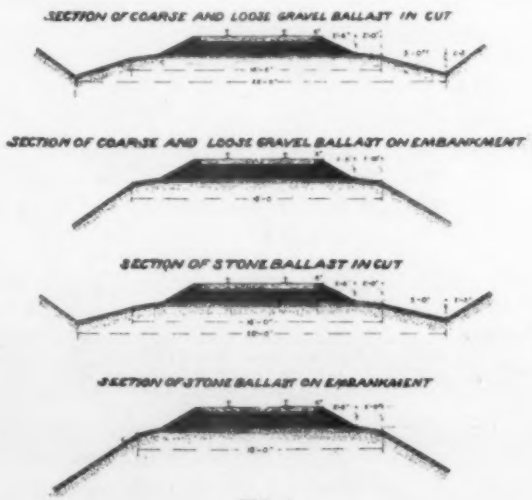
SECTION OF CEMENTING GRAVEL BALLAST IN CUT
SECTION OF CEMENTING GRAVEL BALLAST ON EMBANKMENT

FIG. 3.

and scales removed. The ends of the rails were also thoroughly inspected, and while tightening the bolts the heads of the same were required to be tapped with a heavy hammer, as a safeguard to insure that all joints were tight.

On all the city lines the joints were double bonded, first inside the splices with short, many stranded, arched bonds, and outside with a single heavy copper rod running on the inside of the rail clear of the splice bars at both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SECTION OF COARSE AND LOOSE GRAVEL BALLAST ON EMBANKMENT
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FIG. 4.

NEW ORLEANS ROADBED.

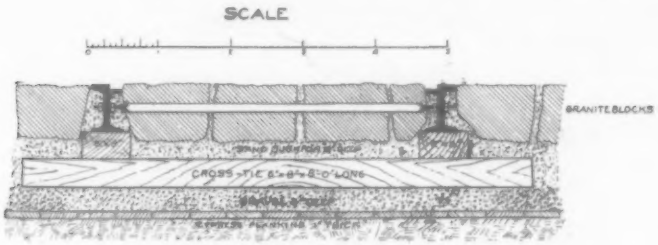


FIG. 5.

ends, and having about one-half inch of slack. Tie rods were also used at intervals of ten feet, drillings for them being made in the center of the web of the rail.

The street railway company is pave in a permanent manner the entire strip which the street railway company was required to maintain.

The following plan was followed: Cement concrete was placed between

TORONTO ROADBED.

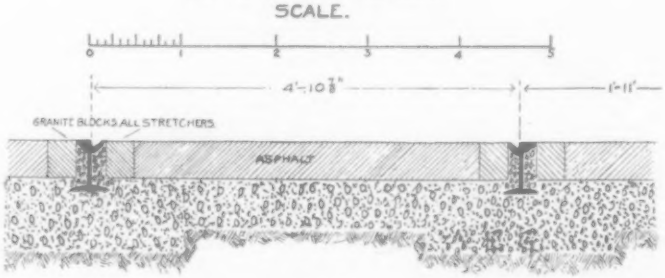


FIG. 6.

required to pave three and one-half feet on either side of the center line of its tracks, and also all space between double tracks, curves and switches. It was therefore decided to pave the space between the rails throughout the city, and re- the ties and to a height of one and one-half inches above them, on all brick paved streets, but care was observed to have no concrete laid on the ties. The space between the rails was paved with brick, laid at right angles to the track and having

PHILADELPHIA ROADBED.

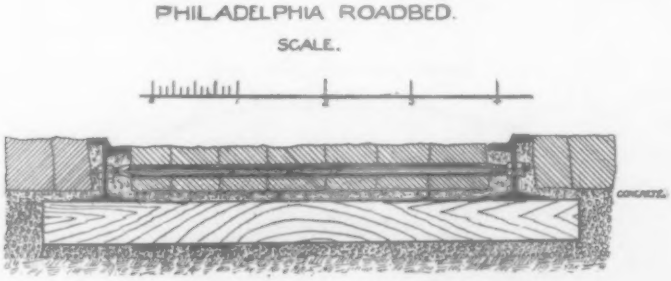


FIG. 7.

one inch crown in the center. A special form of brick was designed, a cut of which I herewith present, designed to fit beneath the head of the rail, and against the web, leaving a groove for the flange of the car wheel, which groove is curved

space between the head of the rail and the base on the outer side of the rail was filled with cement grout, in order to bring it flush with the head of the rail and afford an even bearing for the paving surface.

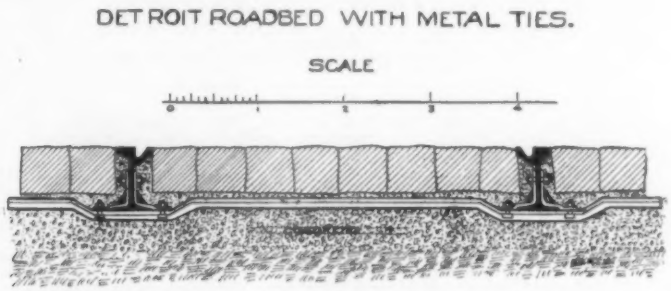


FIG. 8.

or flared so as to allow a narrow-tired vehicle to slip out of the groove easily, if it should drop into it. These brick were made in such lengths that no chipping whatever was necessary, except at special work. On asphalt paved streets the paving was constructed with

I have been able to prepare sections of street railway road-beds, showing the methods of construction followed in a number of cities, which I believe represents the general practice in paved streets, which I wish here to present for your consideration.

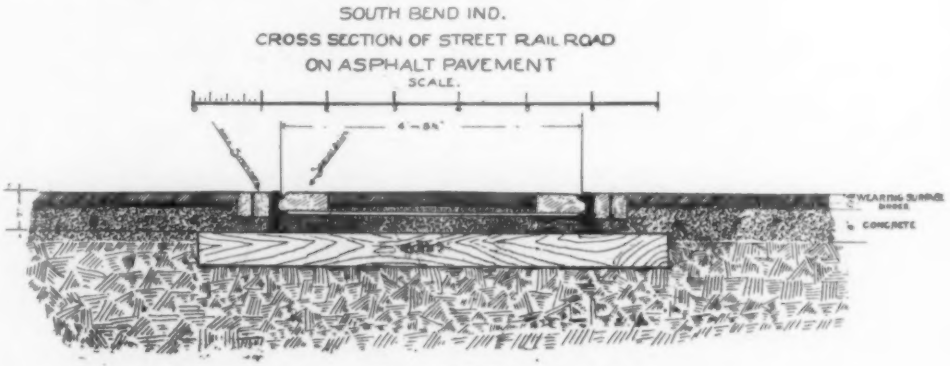


FIG. 9.

two lines of stretchers outside the rail and one row of headers of this special form of brick on the inner side. I have prepared a drawing showing this section, which I have made the standard shape for asphalt paved streets. In both the brick paved and the asphalt streets the

In interurban street car lines the requirements become nearly the same as of a first-class steam road, and I have prepared sections of different classes of road-bed, which I think represent the best modern railroad practice. If sixty-foot lengths of rail are used, particular

care should be observed to leave a proper allowance at joints for expansion. This is so important that I wish to quote from Ganot, who gives the co-efficient of expansion of steel due to a change of one degree F. as .000006.

CHICAGO ROADBED 1895.

SCALE.

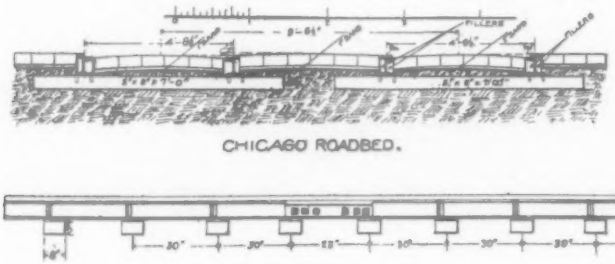


FIG. 10.

The Pennsylvania railroad company made a series of tests to determine the rate of elongation of a steel rail, when subjected to a tensile strain within its elastic limit. The average was found to be .00006 inches per one thousand pounds per square inch. Dividing this by the temperature co-efficient gives 114.6 pounds as the strain per square inch in a rail, due to a change of one degree F., of 11,460 pounds in a change of temperature of one hundred degrees F., which latter is equal to about one-fifth the elastic limit and one-ninth the ultimate strength of steel rail. However, it is probable that five thousand pounds represents the greatest strain due to change of temperature. This brings out a very vexatious question, that of the proper allowance for expansion when laying sixty-foot rails. I have obtained the best results by the use of a F. thermometer when laying track, used as follows: At a temperature of 0 degrees a space of 5-16 inches was allowed, always using an iron schim. At 50 degrees, 3-16 inch space, and in ex-

SPECIAL BRICK FOR T RAIL CONSTRUCTION.
SOUTH BEND STREET RAILROAD.

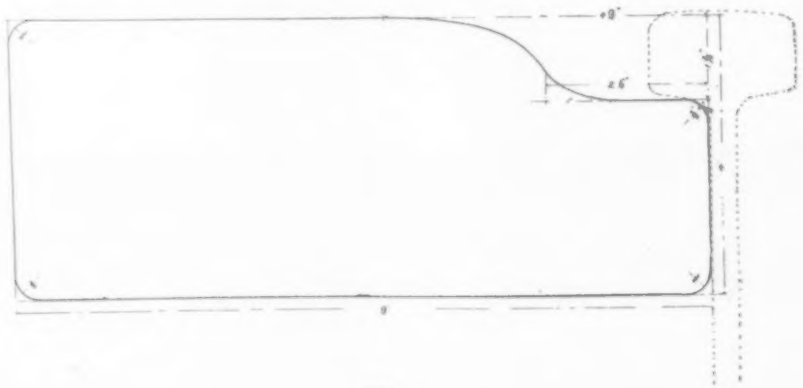


FIG. 11.

treme summer heat, say 90 to 100 degrees F., allow 1-16 inch space.

On the other hand, sixty-foot rails laid in paved or graveled streets and covered to their full depth may be laid closed joints; that is, without any opening at the ends of the rails for expansion. Very good results are thus obtained, as we practically avoid the disagreeable pound due to passage of a wheel. "The worst enemy to good track is water, and the further it can be kept away from the track, or the sooner it can be diverted from it the better the track will be protected. Cold is damaging only by reason of the water which it freezes, therefore the first and most important provision for a good road-bed, and consequently good track, is drainage."

In the construction of the road and in its maintenance, this matter should receive the most careful attention of the engineer. I once had to clear a railroad wreck in a sand cut, thirty feet above the level of water in the adjacent creek, which was caused by water washing down a shallow depression which skirted the very crest of the sand hill caving in the sand from the brow of the bank to a depth of five feet and clear across the track and cut, a distance of some fifty feet. The conditions were frozen ground followed by a January thunder storm. This road had been operated fifteen years, with no previous indication of trouble at this point.

In concluding I wish to say that street railway construction is yet in its infancy, and what is generally considered good engineering practice to-day may be looked on with as much circumspection in a few years as what was considered good street railroad construction ten years ago would be now considered.

T RAIL ROADBED

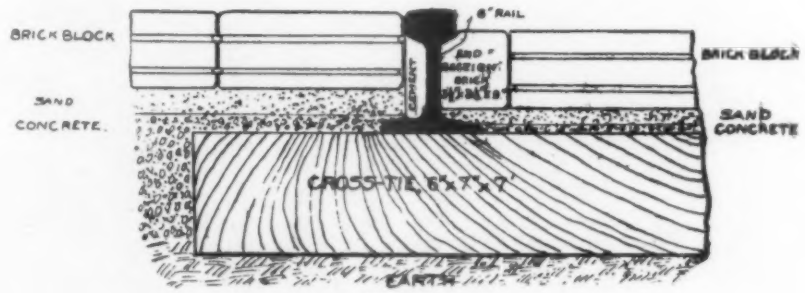


FIG. 12.

The importance to-day of the interurban railroad is not questioned by the most skeptical. Six hundred miles of interurban railroad is a low estimate of the amount which will be built in Indiana alone during the year 1899.

With no limit to the field, and the brilliant promises of the electrical engineers in their special department, I believe we are entering an era of development more extended and far-reaching than any we have yet experienced, and one in which the engineer and the surveyor will play a most important part.

A NEW METHOD OF TESTING PAVING BRICK.*

By Gomer Jones, City Engineer of Geneva, N. Y.

Having occasion during the last year to report to the board of public works of Geneva, N. Y., on the quality of numerous samples of paving brick, I examined a great number of tabulated tests, and was struck with the fact that they had but one point of similarity, viz: The impossibility of drawing from any one test conclusions which would be supported by the mass of other tests.

I found that but few engineers had complied with the recommendations of this body as formulated by the commission of the National Brick Manufacturers' Association, and even when compliance was intended some variable quantity had crept in which made it impossible to bring the various tests into harmony. I was compelled, therefore, to abandon the data presented and establish a starting point from which reliable and equitable conclusions could be reached.

This starting point I assumed to be the formal resolutions adopted at the Buffalo meeting of the N. B. M. A., in 1897, which declared:

That in the opinion of this commission any paving brick which will satisfy the requirements of reasonable mechanical tests will not absorb sufficient water to prove injurious to it in service. We, therefore, recommend that the absorption test be abandoned as unnecessary, if not actually misleading; also,

WHEREAS, From the experimental work done so far by this commission or by others so far as known to us in application to the cross-breaking and crushing tests to paving bricks, it is not possible to show any close relationship between the qualities necessary for a good paving material and high structural strength as indicated by either of these tests.

Resolved, That for this reason the commission recommends that these tests shall be considered as purely optional in the examination of paving material and not necessary as a proof of excellence.

The rattler test remains as the one guide in intelligent selection of material for paving, and it would be infallible if by careful treatment of the mechanical problem involved we are able to eliminate the elements of chance and subject all the material to uniform treatment at the same time.

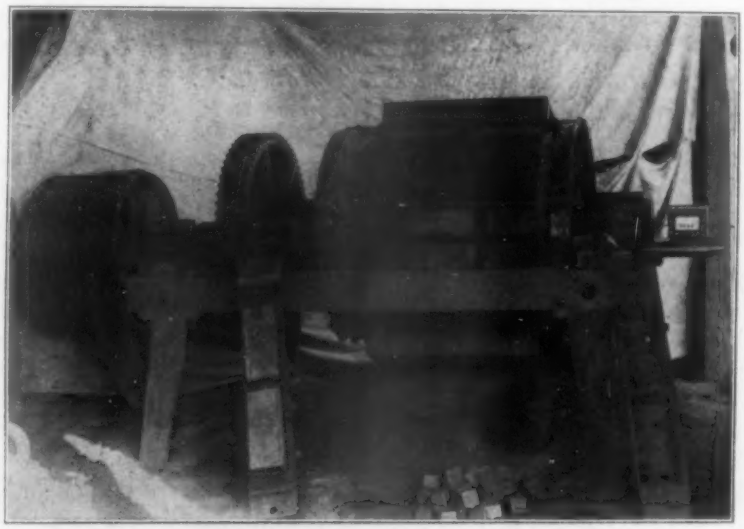
The rattler test proposed by the commission does not do this, because it has been found that only one kind of brick can be rattled at once with uniform results. The abrading material used, viz: brick of the kind tested, has not the same efficiency when a fire clay (which is granular) is used against fire clay, as when shale is used against shale. Weight and form also are factors which can not be disregarded. The lighter brick, though more numerous, to make up the 15 per cent. volume of the charge, do not strike as heavily as larger brick. Then again changes of form take place during the test, and the brick which soonest assumes the rounded form will soonest attain its maximum point of resistance, so that its ultimate wearing qualities, as shown in the tabulated result, will be entirely out of proportion to its economic value.

It is possible to formulate conditions and co-efficients to meet the necessities of any mechanical problem, but in order to do so a long series of experiments must be patiently and carefully conducted, and each element must be given its true

*Read before the National Brick Manufacturers' Association at the annual meeting in Columbus, O., in February, 1899.

value, and even then the application of the same formula by different engineers often leads to widely divergent conclusions.

How can we best reduce the element of chance, do away with all formula that may be controverted and make the test absolutely uniform? I am aware that the answer has been long sought by many, but pardon me for saying it, sought from an unfortunate and ill-considered standpoint, in that they subjected their material to a test which does not reproduce the conditions of actual use on the streets.



BRICK TESTING MACHINE DESIGNED BY GOMER JONES, C. E.

I desire to present for consideration a new method of testing—one that has for its fundamental principle the substantial reproduction of the blow of the horse's foot and the rolling wear of the wagon which follows.

The machine is a rattler with the usual driving gear and accessories, differing from the ordinary rattler only in that instead of plain staves it is provided with staves having two longitudinal pockets each, in which the bricks are inserted and held end to end. These pockets are three inches deep, leaving about one inch of the brick protruding. When all the staves are in place the interior of the rattler is virtually solid brick lined. During rotation the attack of the abrading material is at right angles to the length of the brick, and confined to the surfaces and edges which are exposed in actual use; there is sufficient space between the brick for the escape of any dust or waste, and incidentally to allow the abrading material free access to the unsupported edges of the brick under test, thus reproducing the conditions of position and line of wear found when brick are laid with sand filler in the street.

In selecting abrading material the first point to be decided is the amount of wear or abrasion desirable. My opinion is that the abrasion should be of such amount that at the end of the test the weakest brick shall be in a condition similar to that in which brick worn out on the street are found.

I will not enter into details of the extended experiments that led to the adoption of a cast iron tube one and one-half inches square, weighing eighty-seven hundredths of a pound, as the unit, and one hundred and fifty pounds of such cubes as the charge, but will simply state that when subjected to three thousand revolutions bricks considered standard lose five per cent. of weight, and would be condemned if found on the street.

Having before us a brick-lined rattler, containing a charge of one hundred and fifty pounds of iron cubes, and driven at the rate of twenty-four revolutions per minute, let us analyze the mechanical action and forces. First, the ascending side of the rattler carries up part of the charge of cubes, imparting to them its velocity, and when carried beyond the center they are thrown toward the opposite side of the rattler chamber, and therefore strike upon the unprotected surface of the brick, chipping the edges, cutting into the surface and doing all that the calks of a horse's shoe can do. Second, as only part of the charge of cubes can be carried upward by the ascending side of the rattler chamber the rest slide and roll over the surface of the brick at the lowest point, grinding and wearing them away. Thus we have:

First. Brick in position as in the street.

Second. Continual raining of iron cubes upon the surface, analagous to the blow of horses' feet.

Third. Attrition and rolling wear as of wagons.

Fourth. Wear confined to the narrow surface of the brick, as in the street.

Fifth. Uniform and standard abrading material.

Sixth. Like conditions for testing any material from fire clay to shale.

Seventh. Influence of change or form minimized.

Eighth. Weight, cross-section, form and structure given their true value, as they are all reduced to surface, and resisting quality of material.

Ninth. As only one edge is subjected to abrasion, it is possible to multiply the loss of weight suffered by one brick by the number required to lay a yard, and thus ascertain the number of pounds of material that would be lost from a square yard of pavement laid in the street.

We thus reach the knowledge most to be desired, namely, the loss of weight per square yard. The only consideration modifying the finality of this result is the character of the wear which the bricks would show both when laid in the street and under the test. Some bricks chip on the edges, leaving the surface, as a whole, intact; some become rounded, producing a washboard street. It is not my purpose to consider at present the relative merits or demerits of material as indicated by the character of the wear, but simply to note in passing that by the use of this method it is possible to ascertain the character of wear absolutely and definitely in the laboratory without waiting for the verdict of the streets.

Added to these conditions it is possible to test any number of kinds of brick up to sixteen simultaneously. When the test is started the operator can not change the result.

I will describe a test made by me last year at Geneva, N. Y. Samples were submitted by ten manufacturers. Having such diversity of material, sixteen in all,

in order to eliminate the weakest I put two of each kind of brick into staves which were then bolted to the heads, and having put in one hundred and fifty pounds of abrading tubes, the machine was closed and given three thousand revolutions. The result was that while the strongest material lost less than three per cent., the weakest lost seven and thirty-five one-hundredths per cent., and an interesting fact was disclosed. All the wire-cut brick failed to develop as much strength as the same material repressed. In one instance the difference of abrasion was as between three and fifty-nine one hundredths per cent. in the case of repressed brick and six and twenty-six one hundredths per cent. wire-cut brick. The large fire clay block also failed in comparison with the smaller repressed fire clay brick, and therefore wire cut and large fire clay block were dropped from consideration. It may seem a rather summary procedure to reject material on such a slight data, but extended tests made later justify it.

Having eliminated all but eight varieties, I put four pieces of each kind of brick into the machine, and having given it three thousand revolutions, the brick were taken out and weighed. Having thus ascertained the percentage of loss, while in a dry state, the next step was to test for abrasion after absorption. The brick with one side abraded were put into a tank with an equal depth of water over each and allowed to remain one hundred hours. After weighing they were placed in the machine with the unabraded side up. After testing it was found that the rate of loss was practically the same as when tested dry, thus supporting the conclusion of the commission that the rate of absorption does not seriously affect wear.

I would call attention to the fact that the rate of abrasion as between the wet and the dry bricks can be obtained by the use of this machine on test of the same identical brick, as only one edge is used at a time, and on the second test the abraded side is put into the pocket in the stave.

The result of these tests combined was adopted as the rating of the brick. The fact was developed that shale stood the test better than fire-brick. Our board of public works was of the opinion that both shale and fire-brick should be used on our streets; therefore, we requested makers of brick selected to furnish us two hundred brick to establish a standard for acceptance of shipments. The rating of material was in the order named. Only one of the materials held its original percentage on this acceptance test, but the difference was not great enough to disturb the relative position of each.

Having established a standard, bricks were daily taken from the street, car or wagon, without selection, and subjected to test; thus we were assured that the material delivered was uniform in character. This daily test took time and patience, but the result warranted the outlay, and it confirmed the fact established by testing the two hundred sample brick referred to, that only one material kept up the average of the original samples furnished. This I am satisfied was accounted for by superior care in shipping, and not by willful deception in selecting the original samples.

I shall be pleased to exhibit to those interested half a charge of a recent test, in which three kinds of brick were pitted against cut

Medina stone block. The losses were as follows:

Shale block, No. 1, 2.46 per cent.; Medina stone block, 3.61 per cent.; fire-clay block, No. 2, 3.2 per cent.; fire-clay block, No. 3, 4.6 per cent.

This charge shows the various kinds of wear; also that the action of the cubes is that outlined in this paper, and supports my contention that the new method of testing brick is impartial, certain in its results, and worthy of the consideration of all who wish brick paving to gain an unassailable position before the people.

WATER-WORKS ENGINEERING.

OUTLOOK FOR THE YEAR.

By W. S. Shields, C. E.

In the construction and equipment of our water-works systems so much has been achieved in originality of design and efficiency of operation that it is not easy to relate that which is new or describe achievements above those of the present day practice, so we are content to pause for a few moments and take a forecast into the future to see where to so direct our thoughts and ambitions as to bring us to still greater achievements, and to consider how, by adding our thought to those before us, we may improve the welfare of our fellows by the elimination of things expensive and cumbersome, and the substitution therefor of devices which thought, with skill added, has proven more economical; and whether by comparing notes with each other in societies, magazines and libraries, we may learn how to avoid error, and to wisely direct the expenditure of money so that the artisan and capitalist may receive the greatest comfort and profit from their investment, whether it be in stocks, bonds or municipal tax.

In the outlook over the future of water-works engineering we see much to be accomplished. Our year must be full of books, of plans and of thought. The great achievements of the present day are not the productions of a single brain, but rather the results of many, each adding to the accomplishment of the other the fruits of his experience with combinations made possible by new inventions and discoveries, until we see, in the great triple expansion engine in its highest perfection, the great life-thought of many inventors, and ambitions and skill of hundreds of unknown mechanics. One of our noted divines has said that "Experience supplemented by books teaches more in one year than experience alone will teach in twenty." So to the careful student there are few ideas that are new, and there is scarcely a problem difficult of solution but that someone has already encountered and so blazed the way out of his difficulties in ink that we may all profit by his experience. In social life we are judged to a great extent by the companions which we gather around us, and in like manner, as engineers, our standing may be safely rated by our library. Each

GRAND AVENUE, MILWAUKEE, WIS., PAVED WITH ASPHALT.

new book and magazine article bearing upon our profession adds new responsibility, and to-day he who would achieve success must dig as deep into the causes of success and failures of others as the medical student who dissects the bones and flesh tissues of the dead body that he may be able by knowledge thus gained to lessen suffering and prolong the life of the living. As every artist and poet has his master-piece, so in the life and experience of every engineer comes one great opportunity for achievement, and it often comes unexpectedly, and without warning, and he who would win is found ready to grasp the situation and pass on to success.

In the year that is before us we see much to be done. The crowding from the farm and village to the cities demand that water supplies long deemed adequate must be enlarged. The discoveries by the learned physicians and specialists require that to protect and prolong life greater purity in the supply must be sought, meaning the going deep into earth for the hidden streams, as at Memphis, and more recently at Rockford; the collecting of supplies from springs and subterranean channels, as at Columbus, Dayton or Springfield; the collecting and impounding of large supplies from surface areas, rivers and streams, and its purification for our uses.

In the study and development of these problems we search the world's market for suitable and efficient machinery and devices and bring to our aid combinations of ideas in numerous forms to accomplish the ideal in our mind. The great dam is made to span the valley of some river, impounding millions of gallons of water to be held in store, while near by are filtering galleries for removing the impurities from the water before passing to the pumps to be forced through the immense iron arteries and veins into our homes, there to cleanse and purify, and, taken into the physical system, forms the blood which courses through our veins, creating and sustaining life.

In another city we must go out in various directions and distances, collecting here a number of springs, while there, by a system of collecting galleries or wells, the flow of some underground stream is controlled. Over yonder we are able to further increase our supply by piercing the rock with a number of deep wells; then in a central and convenient location within the city we erect our power plant with our engines, belted to the great dynamos which generate the mysterious power that is transmitted by the copper wire to the different plants, operating them at will from the central station, using only those supplies best adapted by quality for domestic uses, and holding the others in reserve for emergencies. In this unique way we collect the different sources and force them to some central reservoir sufficiently elevated to provide the required pressure. In the same station we provide for the lighting of the city, the furnishing of commercial power for small industries, and that we may be able to operate the plant with the greatest economy an ice plant or some kindred form of manufacture is in progress during the summer season.

Again, we find the only solution of the problem involved may mean a plant for softening the hard water, which is the only available supply, and that it may be controlled economically we must lay a dupli-

cate pipe system for the express purpose of supplying this water for drinking and culinary purposes.

We see the need of our influence in the halls of legislation, in our own state, for more applicable and just laws relating to assessments and to encourage the municipal ownership of our public lighting plants; in our sister state of Indiana, to demonstrate that to raise the limit of municipal indebtedness from two per cent. to five per cent. would not work a hardship but a relief, inasmuch as it would enable the cities and towns desirous of building water and light plants to issue their own municipal bonds, selling them at a premium rather than to compel them to evade the law in order to secure their necessities, by contracting on the franchise system now so extensively in vogue throughout the state, and on completion of an inferior plant, because designed by contractor to suit his stock of materials, they assume the payment of the mortgage bonds which have been discounted ten and in some cases even twenty per cent.

We need to stand by our state boards of health in their effort to guard against disease and epidemic, to secure laws for preserving purity of our rivers and the destruction of waste and refuse from our cities. We may encourage and strengthen their hands in their fight against indifference, prejudice and incompetency.

Looking still further into the field before us we find need of our skill and experience in the management of plants already constructed, but which, on account of their present management, are not a revenue producing investment, either for the private company or for the municipality. The original plant, which is often of questionable efficiency at first, has been improved to suit the peculiar ideas of each succeeding superintendent until there is little of the original left. The condition of the boilers, their setting and piping, allow of constant loss. The devices for heating the feeder and utilizing the waste heat are either inadequate, defective or lacking entirely. The fireman may be shoveling the price of his wages into the furnace to go out in smoke. The suction pipes are often too small or improperly arranged, and the distribution system, by yearly extensions to suit the property-owner, has become so cramped and congested that unnecessary energy must be consumed in overcoming friction. These faults with undiscovered leaks and unreported connections may cost several hundred dollars yearly in the operation of the plant. Politics will often prevent our employment in this capacity in public plants, but the necessity exists, and the private company as well as the municipality could well afford to pay us a small yearly salary for our experience and advice in this direction.

Our year will be much as we make it—thin and empty of results successfully achieved, or full and rounded, doing with conscientious care the small problems, and thereby fitting ourselves for the greater ones, which are as sure to follow as rain after a drought, ever remembering that only success achieved by honesty and strict integrity will entitle us to stand before the world and demand a share of its praise and admiration.

Who shall limit our task or fix the responsibility of him who gives to the millions their daily drink? And our reward—what shall it be? Who shall measure our influence upon mankind, or name the price of our labor and thought?

A NEW FORM OF SEWER INVERT BLOCK.*

By Arthur N. Talbot, C. E.

In the design of a sewerage system for our flat prairie towns and cities, the engineer frequently meets with conditions which make the use of gradients sufficient to give so-called self-cleansing velocities impracticable. Large sewers are especially subject to limitations of gradient, since their crown must be kept down in business and residential districts and their invert must be held up according to the level of the outlet waters. In the combined system, the ordinary dry weather flow of sewage occupies but a small part of the capacity of the sewer, variously estimated at 1-50 to 1-200 of the full capacity. If, as a recent writer states, the minimum allowable velocity of the dry weather sewage is 1.5 ft. per second, and this discharge is 1-120 of the full capacity of the sewer, the velocity when full, that for which the gradient is usually calculated, must be 6 ft. per second—a velocity which frequently is difficult to secure.

The most common device for bettering such conditions is the use of egg-shape sewers. Two advantages are named for this section: 1. Increased velocity over the circular form; and 2, greater average depth of flow.

COMPARISON OF VELOCITIES IN EGG-SHAPED AND CIRCULAR SEWERS.
Kutter's Formula, n=.015, s=$\frac{1}{1000}$.

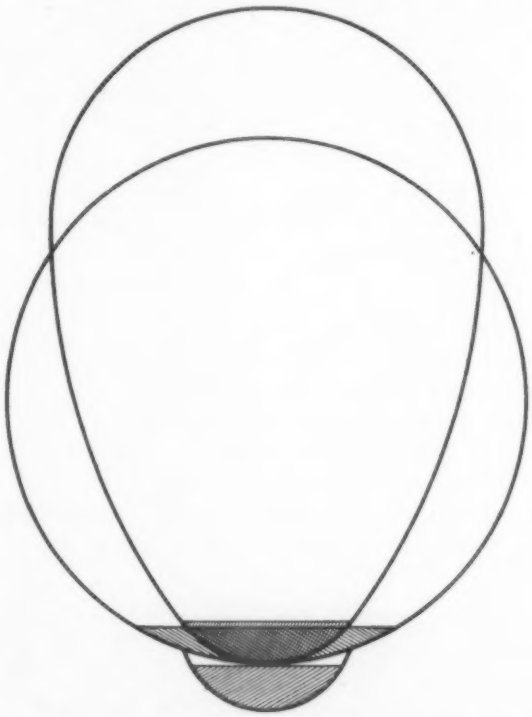
SECTION.	Depth.	Area, Sq. Ft.	R.	C.	V.	Q.	Capacity.	Ratio of V. to V. for Full Sewer.	Ratio of V. in Egg to V. in Cir. for Same Q.
CIR.									
30 in.....	30 in.	4.909	.625	89.6	2.24	10.97	1.0	100%	
	9 in.	1.287	.427	81.8	1.68	2.22	.2	75	
	4.5 in.	.460	.230	69.2	1.06	.49	.05	47.6	
	2 in.	.147	.112	55.2	.58	.08	.01	25.8	
EGG.									
24 in. x 36 in...	36 in.	4.594	.5794	88	2.11	9.693	1.	100%	100%
	12 in.	1.136	.4132	80.9	1.64	1.863	.2	77.7	103
	6 in.	.428	.2722	72.4	1.19	.508	.05	56.4	118
	2.4 in.	.120	.1317	57.9	.66	.079	.01	31.2	120
CIR.									
48 in.....	48 in.	12.57	1.	99	3.13	39.34	1.	100%	
	14.4 in.	3.17	.684	91	2.38	7.54	.2	75	
	7.2 in.	1.22	.368	79	1.50	1.83	.05	47.9	
	3.3 in.	.46	.176	64	.83	.38	.01	26.5	
EGG.									
40 in. x 60 in...	60 in.	12.761	.9667	99.2	3.15	40.12	1.	100%	100%
	20 in.	3.156	.6887	91.6	2.29	7.45	.2	76.6	102
	10 in.	1.185	.4537	83.6	1.78	2.11	.05	56.5	118
	4 in.	.333	.2195	66.6	.99	.33	.01	31.6	119

The writer believes that the first of these is generally greatly overestimated. The following table is based on Kutter's formula, using the actual value of the hydraulic radius for the different depths. The two sizes, 30-in. circular and 24x36 in. egg-shape, have nearly the same discharging capacity, as have also the 48 in. and the 40x60 in. It will be seen that the velocity in the egg-shape sewer for small flows is in all cases less than

*Read before the Illinois Society of Engineers and Surveyors at its annual meeting, January, 24-27, 1899.

20 per cent. in excess of that in the circular for the same quantity of sewage. This difference would not of itself pay for the extra cost of the egg-shape form. It may be said that the statement in Folwell's "Sewerage" that the egg-shape section gives 85 per cent. greater velocity than the circular is erroneous.

The second advantage, that of depth, is more clearly in favor of the egg-shape, as shown by the attached diagram.



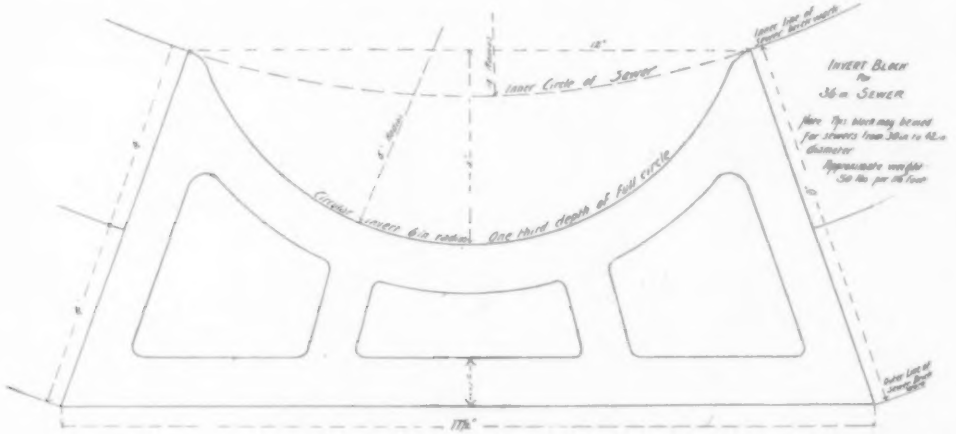
For sewers of the same capacity, the egg-shape contains about 10 per cent. more material than the circular, and its barrel will then cost approximately 10 per cent. more. Some gain will be made in the narrower trench required by the egg-shape, but the expense will not be directly proportional to the width. If the elevation of the crown is fixed by surface conditions, the invert of the egg-shape must be the deeper, adding more than proportionally to the increased depth. In general, then, it may be said that the egg-shape sewer will cost from 5 to 10 per cent more than the circular.

There may be conditions, too, which will permit a better gradient for the circular form than for the egg-shape, as, for instance, where the elevation of the crown of the sewer at the upper end of the size under consideration is fixed by the depth of cellars and the elevation of the invert at the lower end is governed by the level of the outlet allowable, and this may more than counteract the sectional advantage.

While, then, there are many local conditions which render the use of egg-shape sewers advantageous, it is probable that such conditions are not so common as is usually supposed. Usually, too, 40 x 60-inch is as large an egg-shape section as it is desirable to use.

The writer now desires to present for comparison with the egg-shape section a new form of invert block for use with circular sewers.

Vitrified invert blocks are not new in sewer construction. As generally constructed, they fit the general outline of the sewer, are smooth, give drainage during construction, and are advantageous in wet ground and where it is difficult to form the trench for the circular section. In some cases contractors put the inverts in, themselves bearing the additional cost for the sake of the saving in labor or otherwise in the construction of the sewer.



In the form now suggested the surface is depressed below the invert line of the circular sewer, thus resembling part of a pipe sewer. In the diagram it is depressed 4 inches and given a radius of 6 inches. When flowing to the full width of the invert, the effect would be the same as a flow in a 12-inch vitrified pipe 4 inches deep. For a 36-in. sewer this discharge would be about 1-75 of the capacity of the sewer, and counting the invert as smooth as sewer pipe the resulting velocity would be 45 per cent. greater than that for the same flow in the circular brick sewer. Similar results would be obtained for 30-in. sewer. With flat gradients liable to deposits for shallow depths of flow, the contrast would be even greater than this.

On the second point, morever, the average depth of flow, the advantage is even more apparent, as evidenced by the diagram of depths. The contrast is greater than with the circular and egg-shaped sections.

The element of sub-drainage is present also, an important one where ground water would not permit well-filled mortar joints to be constructed in the invert.

The general form given in the diagram, of course, is subject to modification in many particulars. It would be easy to avoid the difficulty of a single vertical joint by making a shoulder on the end of the section. The form given in the diagram is easily applicable to 30 and 42 in. sewers.

Pipe manufacturers report that this block will not be difficult to make and that it will not be unreasonably expensive. One firm says it can be sold at 25 cents per foot. As there is a saving of about 18 brick per lineal foot the additional cost of this invert block in the sewer will be from 10 to 20 cents per foot.

DEVELOPMENT OF THE PAVING BRICK INDUSTRY.*

By A. D. Thompson, City Engineer of Peoria, Ill.

It would be presumptuous for me to attempt to present to this association the principles governing the selection of the material or the details of manufacture necessary to produce the best paving brick. Hard-burned clay building brick were laid in the original experiments, but it was soon apparent that they were not suited to withstand the wear in the streets. These hand-made, sun-dried bricks burned in temporary kilns were too soft, weak and porous and the manufacturer immediately attempted to better his product, and each fault has been remedied as rapidly as developed. The raw material is selected with great care, the choice being confined to a very narrow field since the best results are obtained from material containing the proper proportions of certain ingredients, such as silica, alumina, magnesia, etc. The raw material is ground to almost the fineness of flour, screened on fine screens, thoroughly mixed and molded in machines under immense pressure. The green product is then dried rapidly in steam or hot air dryers and burned in down draft kilns under a steady heat, until the material becomes a vitrified, homogeneous mass of wonderful strength and toughness. All these processes have been reduced to an exact science requiring great skill and experience, and the least variation from the proper manipulation seriously affects the quality of the product. The raw material must contain a certain amount of moisture, the machine must operate at a certain rate, the temperature of the drying kilns must be accurately gauged and the bricks must be vitrified sufficiently to be tough, but not brittle. The edges of the bricks are made round instead of square in order to prevent excessive chipping, and many manufacturers repress the bricks before drying, to make them more uniform and regular. Elaborate discussions have also been held between manufacturers as to the merits of side-cut and end-cut bricks, which indicates the thoroughness of their investigations regarding the details of manufacture.

The excellent results obtained from brick paving in the past twelve years, even when constructed of poor materials and with unstable foundations, has led to its general adoption and rapidly increasing use in American cities. In 1897 the writer, as chairman of the committee on street paving for the American Society of Municipal Improvements, collected data from 122 cities in the United States having a population of 10,000 or more, regarding the total amount of paving laid and the amounts of the various kinds laid in 1895-6-7, together with the costs of same. This information showed that in 1896 the amount of brick pavements laid in these cities increased 32.5 per cent. over the amount laid in 1895, while the amount of asphalt increased 28.4 per cent. in the same period. On the other hand, the amounts laid in 1896 compared with 1895 showed a decrease in percentage of other pavements as follows: Gran-

*From a paper read before the annual meeting of the Illinois Clay-Workers' Association, held at Peoria, in January, 1899.

ite, 48.8; wood, 9.1; sandstone or trap rock, 54.2. These figures prove, conclusively, that brick and asphalt are rapidly replacing granite, wood, sandstone and cobblestone for paving purposes, and that brick is used more extensively for paving than any other material.

The price of all pavements has decreased materially during the past few years, but the effect of the general adoption of brick, upon the prices of other paving materials with which it is a direct competitor, is shown by the fact that in 1897 the average cost of brick paving was 9.3 per cent. less than in 1895, while other pavements during the same period decreased the following percentages in cost: Asphalt, 16.8; granite, 3.0; wood, 9.9, and sandstone or trap rock, 20.1. The slight decrease in the cost of granite is explained when it is considered that this material is used only in the largest cities and upon streets where no other material will withstand the wear. It practically has no competitor among other paving materials, although brick promises to become a dangerous rival.

Brick pavements have acquired in the United States a front rank among the older pavements in a relatively short period, and past experience indicates a still wider adoption and more general use in future improvements. Great advancement has been made in the quality of the material and methods of construction, but many defects remain to be remedied. Should improvements in the quality of brick and construction methods continue at the same rate as in the past, the brick pavements of the near future will possess, in addition to other qualities, the smoothness of asphalt, the quietness of wood and the toughness of granite.

THE SEPTIC TANK OF THE CHAMPAIGN SEWERAGE SYSTEM.

By Arthur N. Talbot, C. E.

The septic tank at the outlet of the Champaign sewerage system was planned in 1895, taking the best of the features of the one built by the writer in Urbana in 1894, and has been in operation since November 1, 1897. Some study has been made of the operation and workings of this tank, and it may be of interest to give some of the results of this observation.

For the benefit of those who may not have seen the description of the Champaign septic tank, it may be well, briefly, to describe the plant. Two masonry tanks 8 feet wide, 37 feet long, and having a depth of 5 feet of water, lie side by side. The sewage flows into each of the tanks through a diverging channel arranged to distribute the flow well over the cross-section of the tank, and flows out of the opposite end, perhaps a half inch deep, over a weir the full width of the tanks. The effluent then flows through the sewer into the creek. Across the tanks at intervals are partitions which go down 2 to 3 feet below the surface, trapping the floating solids and preventing surface currents. These tanks are inclosed in a brick building which is dark and without ventilation. A centrifugal pump run by a steam engine is used to pump

out the accumulated sludge whenever necessary. The action of the tank is continuous and no attendance is necessary. The action of this tank seems to involve the following operations.

1. The mechanical separation of suspended solids, the heavier matter settling and the lighter floating.

2. The reduction of the retained organic matter by bacterial action, gases being given off and the ash settling, leaving some inorganic compounds to be carried off in the effluent.

3. A similar reduction in organic matter in solution, though to a smaller degree.

4. A breaking down of the compounds so that a further purification is made in the stream after leaving the tank much faster than would otherwise be effected.

A number of chemical analyses of the sewage and the effluent have been made by the department of chemistry of the University of Illinois. Difficulty is encountered in getting samples of sewage typical of the general flow, since its composition is so changeable. The effluent is much more uniform in character. To avoid this objection several samples were taken on some days. The most satisfactory method, however, is to take composite samples by mixing samples of sewage taken hourly through twenty-four hours in amounts proportional to the rate of flow at the time the sample is taken. A composite sample of the effluent was also taken.

From the results of these analyses it appears that from 80 to 90 per cent of the organic matter is represented by the albuminoid ammonia, by the oxygen consumed, and by the total organic nitrogen, is taken out. A still larger percentage of the organic matter in suspension is taken out. It may be said that these results are better than the results ordinarily obtained by the chemical precipitation process, and nearly as good as the winter results of some of the intermittent downward filtration processes. The chlorine and the volatile matter are not distinctive of results, since both these are very high in the ground water reaching the sewer.

The effluent during the time this study has been made (since September, 1888) has been fairly clear, free from odor and unobjectionable. Part of the time the sewage has been considerably diluted with ground water which leaks into the sewer. Analyses at such times of course show an effluent much better than if only sewage reached the tank—a water chemically better than that of some shallow wells in this city. The effluent at the time when little ground water was coming in was reasonably good—1.3 part of albuminoid ammonia per 1,000,000. This effluent may be discharged into a small stream without objectionable results.

Analysis also indicates that there is a further reduction within a short distance as the water passes down the stream, but this is not fully established.

The sludge at the bottom is a thick black mud; that at the top is a light matty mass. The tanks have been pumped out, at least partially, three times. The discharge is into a pit near the bank of the creek. Only a slight odor arises from the discharge, that of dirty water. No trouble is anticipated from this.

During the winter the cold ground water has reduced the temperature of the sewage to about 47 F., and at this temperature the bacterial action seems to be mate-

rially checked. Without the cold addition to the sewage, it is probable that the efficiency of the septic tank will be nearly as great in winter as in summer. In the autumn the temperature of the sewage in the tank averaged about 54 F.

To those intending to design such tanks a few suggestions may be given. In general, the design of this tank is satisfactory. The weir at the effluent end is efficient and probably the building is sufficiently dark and tight. The depth of water may profitably be greater, at least 6 feet and better 7 feet of depth. A somewhat longer tank would be advantageous, giving opportunity for another detaining partition. As to the width, it is probable that with widths greater than 10 feet there would be difficulty in getting uniform flow; that is, when the tank became partially obstructed, there would be more opportunity of a tortuous channel being formed through the tank.

Experience with the Champaign septic tank has shown that this method is applicable in many places when the sewage would cause objectionable nuisance if discharged into a small stream. It is believed that the method, if properly developed, will prove to be an important one. Of course, in many instances it may be necessary to provide further means of purification, but even then, as a preliminary process, this method would be valuable.

THE RELATIVE VISCOSITY OF ASPHALTS AND ALLIED BODIES.*

By A. W. Dow, Inspector of Asphalts, Washington, D. C.

It was not long after the laying of the first asphalt pavement, made under the De Smedt patent, which consists of an artificial mixture of a more or less pure asphalt cement with sand and dust, that the question presented itself of how to determine when the asphalt cement was of the proper degree of softness or consistency. I use here the word softness or consistency to better express my meaning to those who are not acquainted with the physical properties of asphalt and asphalt cements (more correctly speaking it is viscosity, but this might convey the idea that asphalt cements were fluids in the sense which is generally understood). If we look into the properties of asphalts and asphalt cements, such as are suitable to be used in pavements, we find that they are, truly speaking, fluids; that they have a marked flow at ordinary temperatures, and that they will flow until stopped by some confining body or until an equilibrium has been reached. To illustrate the flow of these very thick liquids, an asphalt, which was so hard that the pressure of a nail hardly left an imprint, was molded in the shape of an ordinary brick. This asphalt brick was placed on end in a room that was kept at ordinary temperatures. In the course of several months it flattened down into a pat but three-quarters of an inch in thickness.

An asphalt cement which is really

*From the report of the operations of the Engineering Department of the District of Columbia for the year 1898.

nothing more than an asphalt of the proper consistency to be used for paving is so fluid that it must be kept in a tight box, and if a small piece of metal should be left on its surface it will sink from view in a day or two. This viscosity of asphalt increases or diminishes as its temperature is raised or lowered. For this reason great care should be taken in comparing two or more samples that they be all of the same temperature. The first method devised to determine whether an asphalt cement was of the proper degree of softness to produce a good pavement was by chewing a small piece and judging by the resistance it offered to the teeth. This method is not as inaccurate as it would seem at first to be. All mouths are pretty near the same temperature, and the general rule followed was that if an asphalt cement chewed easily and yet was not soft enough to adhere to the teeth it was of the proper consistency for paving. This method is, however, not all that could be desired, as the viscosity could not be expressed numerically, and then, as knowledge as to the way of laying asphalt pavement increased, it was recognized that to produce the best results the viscosity of the cement should differ in different climates, and also according to the character and proportion of sand and dust used.

In 1888, Mr. Bowen, then head chemist for the Barber Asphalt Paving Company, filled the long-felt want for such tests by devising an apparatus to determine the relative viscosity or softness of asphalt and allied bodies. The principle of his apparatus, which is generally spoken of as a penetration machine, is to determine the distance a weighted needle will penetrate into an asphalt at a standard temperature in a given time. This is accomplished by having a large needle inserted in the end of a weighted lever arm. This lever arm is suspended by a linen thread from a spindle around which it is wrapped. At one end of this spindle is fastened a pointer which indicates on a dial the distance up or down moved by the lever arm carrying the needle. On this spindle is a small drum round which winds a thread supporting a weight which acts as a partial counterbalance to the weight of the lever arm. This counterweight keeps the lever thread taut, and when the lever arm is raised it returns the pointer on the dial. The viscosity of a sample is determined by placing it under the needle, which is then lowered until its point just touches the surface of the sample. The position of the pointer on the dial being noted, a clamp is released which allows the needle to penetrate into the sample for any fixed time. At the end of this time the clamp is closed and the distance the needle has penetrated can be read from the dial. Care must be taken that all samples be kept at a standard temperature for at least half an hour before making the test. This is accomplished in several ways, the most accurate being to keep the machine and samples in a small room kept at a standard temperature.

The method most generally in use at paving yards, or where it is impracticable to keep a room for this purpose, is to keep the samples in a tank of water at the standard temperature. To make the test the sample is quickly removed, dried and tested, as before. Unless the temperature of the room is abnormally high or low, two or three tests can be made on the sample before its temperature is sufficiently

changed to materially affect the results. I have used a modification of this method that works very well, doing away with the errors caused by the evaporation of water from the surface of the sample, and the influence the temperature of the surrounding air has on it after removal from the water tank. A small glass dish is kept in the tank with the cements, and when a test is to be made the sample is removed from the tank in this dish, being completely covered with water of the standard temperature. The needle is then set to the surface of the sample as before, by looking through the sides of the glass vessel, and the test made while the sample is submerged. That this apparatus of Mr. Bowen has proved itself practical and useful for the work it was intended to do will be better appreciated when I say that there are at least twenty-five paving yards throughout the country equipped with it. They are operated by the foreman in charge of the yard or his clerk, and it is remarkable what good results are obtained. It can be seen that the field of usefulness of this apparatus in its present form is limited to determinations made at or near the normal temperature, while it is often desirable to compare the viscosity of asphalts, etc., at, say, winter or summer temperatures. Another objection is that it is impossible to accurately determine the exact weight acting to force the needle into the sample owing to the friction at the fulcrum of the arm and the friction of the spindle in its bearings, and also calculate the force expended in overcoming the inertia of starting the several portions of the machine into motion, and it is impossible to get concordant results with two machines unless they are built exactly alike.

In the machine I have devised I have endeavored to overcome these objections. The tests are all made in a water-jacketed copper box. Any temperature can be obtained in this box by running through the jacket water cooled or heated as desired. The needle penetrates under a direct weight with practically no friction. The description of this apparatus in detail is as follows: The penetrating needle, which is an ordinary No. 2 sewing needle, is rigidly fastened in the end of a small brass rod. This rod is inserted in the end of an aluminum tube, about 40 centimeters in length and one centimeter in diameter, where it is securely fastened by means of a binding screw. By filling or partially filling this tube with mercury it can be made of any desired weight from 30 to 300 grams, after which it is closed by a cap which screws on to the end opposite the needle. When this cap is screwed into place, its surface, which is perfectly flat, is absolutely at right angles to the sides of the tube. The aluminum tube holding the needle passes down through a wooden framework in which it is held in a vertical position, with the needle end down, by means of a jaw clamp. When this clamp is released the tube can move freely up or down, while it is retained in its vertical position by two guides. These guides are each made of two metal plates a fraction of a centimeter in thickness. Each plate has a semi-circular piece cut out of one side, so that when the two are placed together it leaves a circular opening through which the aluminum tube passes freely, but yet not so freely as to get out of the vertical. To facilitate the removal of the needle tube from the framework, as it must be slightly inclined while withdrawing so as to

clear the measuring device, the guides are constructed so that one plate in each can be pushed a short distance from the other, thus allowing the inclination of the tube. These plates are returned to their original position by springs.

In the upper part of the framework, directly over the tube, is a spindle 3.17 millimeters in diameter, with a pointer on one end which turns on a dial. A small plumb weight is suspended from the spindle by a fine platinum thread which winds on it. This weight is partly counterbalanced by a second weight suspended from the spindle by a linen thread. These weights are so that if they be allowed to move freely the former is just sufficiently heavy to cause it to fall gradually, and when the aluminum tube is in position this weight will fall until it just touches the surface of the cap on the top of the tube. The fall of one centimeter of this weight causes the spindle to make one revolution, thus making one revolution of the pointer on the dial equivalent to one centimeter. The above framework is fastened onto the cover of a copper chamber, the aluminum tube projecting through this cover into the chamber, needle end down. This cover, which is of wood, is made in two thicknesses, with an air chamber between, thus more perfectly insulating the interior of the chamber from the outside air. It is supplied with two large windows on each side of where the needle tube passes in, admitting light and allowing the operator to see the sample. The chamber to hold the samples, which is of thin sheet copper, is constructed with a rounded bottom like a kettle, and is fitted with a flat false bottom, or flooring of sheet iron raised above the flooring about an inch, resting on three rollers, is a circular disk, on which the samples as tested are placed in a circle about half an inch from the edge. This disk can be rotated like a turntable by means of an iron rod which passes through its center into a bearing on the floor and out through the cover of the chamber, where it is fitted with a wheel. By turning this wheel, thus revolving the disk, each sample on it can be brought in turn under the penetrating needle. In this way twelve samples can be tested by this particular apparatus without opening the chamber. Two swinging mirrors are fastened—one on each side of the copper chamber—one mirror being so adjusted as to throw light on the sample to be tested, while the other reflects the image of the sample so that it can be seen by looking in through a window in the cover. This copper chamber is fastened into a lead-lined tank, which is filled with water of any degree, or a freezing mixture, as the case may be, to produce the desired temperature in the chamber. To keep this temperature constant the tank is supplied with one inlet, in the center of the bottom, and four outlet pipes, one on each side near the top. The temperature of the copper chamber is regulated by a simple electrical thermostat suspended in it, which will cut off or let on a supply of liquid or water entering the tank as the temperature requires.

In making a test or tests the samples are placed in position on the disk in the copper chamber, the cover with the apparatus put in place, and the chamber secured in the lead-lined tank. The water or liquid of the desired temperature is run into the tank, which is allowed to fill and run off by the overflow pipes. The entire apparatus is then leveled by leveling screws in the

feet of the tank until the needle tube is perfectly vertical. When asphalt is to be tested it is for convenience put into small round tins like small blacking-boxes. By heating just sufficiently to melt it a smooth surface is obtained with quite a gloss. These boxes containing the samples are placed on the revolving disk, each sample resting on two raised points on the surface of the disk, this giving them a slight incline. The table is then revolved until the needle is very nearly in contact with the surface. The surface of the sample being slightly inclined, it can be brought just in contact with the needle by a slight revolution of the disk. By arranging the mirror on top of the cover so that it will reflect the light from a window down upon one of the mirrors in the chamber—which in turn reflects it on the surface of the sample—and then having the other mirror in the chamber in such a position as to reflect the image of the sample up, the needle can be set accurately to the surface by watching its reflection in the surface of the sample. To determine the penetration the reading of the dial is taken, the clamp is released, which allows the needle to sink in the asphalt under the weight of the tube. The apparatus is so constructed that when the clamp is released from the tube another clamp closes on the thread of the counterbalance weight, thus preventing the plumb weight from falling and adding its weight to that of the tube. On clamping the tube again at the expiration of the desired time the thread of the counterweight is released, which allows the plumb weight to sink until it is checked by the top of the tube. The present reading of the dial, less that before taken, is the distance the needle penetrated into the sample. Readings can be made with accuracy to one-fiftieth millimeter.

RELATION OF CONSTITUTIONAL LIMITATION OF THE FINANCIAL POWERS OF MUNICIPALITIES TO PUBLIC WORKS.*

By Prof. Charles W. Tooke,

The problem of successful municipal government is the most prominent question in the non-partisan politics of the day. In this critical state of industrial evolution, American cities have had thrust upon them unusual conditions, to be met at once, without experience to guide or direct their action.

No assertion, perhaps, is more freely made by writers upon municipal reform than that the most striking evidence of the inefficiency of our municipal government is the immense burden of debt carried by our cities, counties, villages and towns. According to our best statistics, which for the earlier periods, however, are only approximate, the municipal indebtedness of the United States in 1843 was about 27,500,000. By 1870 the total local obligations, minus the sinking funds, had increased to $515,000,000; in 1880, to $826,000,000, and in 1890, to $906,000,000.

The early history of permanent

*Condensed from an address before the Illinois Society of Engineers and Surveyors.

municipal debts in this country really begins with the abandonment by the states of their policy of aiding internal improvements, a policy which had held sway from about 1830 to 1850. After the incorporation into the constitutions of most of the northern states of provisions forbidding the state from loaning its credit or taking stock in any work of internal improvement, it was quite natural that the legislatures, in response to the demand of the people should have empowered the local subdivisions to give aid to the many railroads, canal and turnpike companies, which promised to open to them the markets of the world.

While in most cases these debts were perfectly legitimate, there was early engendered a tendency to extravagance, and too often heavy obligations were incurred without any immediate provisions looking to their subsequent cancellation. Suffice it to say that the legislative control over municipalities in this respect proved so inadequate that constitutional provisions were gradually adopted in most of our northern states from 1850 to 1875, restricting the financial powers of cities, counties and towns, not only from loaning their credit to such enterprises, but also from incurring indebtedness or levying taxes beyond a certain percentage of their assessed valuation.

The constitution of 1848 of Illinois incorporated the provision already in force in several other states, that the credit of the state should not in any manner be given to or in aid of any individual, association or corporation. As early as November, 1850, the supreme court of the state, in the case of the County of Richland *v.* the County of Lawrence (a), indicated that this provision would not limit the power of the legislature to authorize the local subdivisions to loan credit in aid of individuals or corporations for the construction of works of public utility; a principle finally settled in the case of Prettyman *v.* The Supervisors of Tazewell County, decided in April, 1858. * * *

In our smaller cities the combined effect of the debt limitation and the under assessment due to the operation of the general property tax has been frequently to bar absolutely the undertaking of works of public utility which in some cases have been demanded by imperative necessity. Many of the smaller cities are thus precluded from building their own waterworks and lighting plants and even from constructing sewer systems, not to mention their local transit lines.

The great increase of municipal indebtedness in recent years is due as well to the intensive as to the extensive developments of cities—that is, the increasing needs of cities of a given population, which have multiplied even faster than the number of cities. Thus, late in 1820 Governor Dewitt Clinton recommended a water supply and common sewers for the city of New York, then a town of 123,000. Today, in Illinois, of the 44 municipal water plants no less than 21 are owned and operated by cities or villages having 2,000 inhabitants or less. Thus it is that the intensive needs of our municipalities have developed, and the call is for municipal ownership also of the lighting plants, but the limits named will not allow it.

I do not care to argue in passing the superior advantages of municipal ownership of both water and lighting plants. Not only is the economic advantage of an unlimited and exclusive and unrestricted

franchise, which a municipality alone may enjoy undisputed, but it is evident to any one who cares to examine the statistics of water companies of Illinois under private and public ownership, that under the latter system the public does reap the benefits of the profits that in other cases would go into the pockets of individuals. In 1897 the average cost per family of 18 plants under the system of private ownership in Illinois was no less than $7.77, while for some 44 plants under public ownership the average cost was but $5.66 per annum. What municipal ownership can save the people in this line can be duplicated in the matter of lighting. * * *

The easiest solution that suggests itself is the abolition of the constitutional prohibition that limits the amount of indebtedness. Another plan that readily suggests itself is a reform of our system of state and local taxation, which has long ago outgrown its usefulness, which allows practically all personalty to escape the burdens of government, and which bears with increasing weight upon those classes of the community which are the least able to pay the taxes. If we adopt the plan so successful in Pennsylvania, which is about to be consummated in New York and Massachusetts and to which all the leading states are tending, namely, that of raising our state revenues from personalty, by taxes on corporations, inheritances, etc., leaving the real property subject to taxation for local needs alone, the temptation to the under assessment which now prevails would be removed, and the limitation would thus be lifted so as in all probability to allow cities to undertake such public works as might be needed.

A method of control which has proved of uniform success wherever tried in providing an efficient and yet elastic supervision, adaptable to the conditions of each municipality, is the method of administrative control which exists on the continent and in England, and to which several of our own states are rapidly tending. Under the English system the municipalities are granted a wide power of building public works, being restricted by the requirement that no such work be undertaken, or money borrowed therefor, unless upon approval of the local government board. The local government board is careful to ascertain whether the public work in a given case is necessary, whether the estimates are excessive, and whether the financial management of the municipality in the past has been successful. If the investigation is favorable to the enterprise, it superintends the financial side of the undertaking, and sees to it that a proper sinking fund is created to pay off the indebtedness within the period provided by law. Under the operation of this system of control since 1875, the municipalities have been able to engage extensively in public works demanded by their local needs, and with uniform financial success.

In my own opinion there is no need to remove the constitutional limitation, but I firmly believe that a reform of our taxing system, which is bound to come within a few years at most, calls for the creation of a state board of local works, which may at first be purely advisory, but whose powers may later be extended to exercise a control similar to that of the local government board, as soon as the need of such control arises. Some of our states already have similar boards, as notably the Electric Light Commission of Massachusetts, and it is worthy of note

that in his recent message Governor Roosevelt of New York recommended the establishment in that state of such a municipal board for cities of the second and third classes.

Central administrative control is the keynote of the programme that must be followed if we are to obtain that ultimate goal desired by all friends of the movement for better municipal government, namely, a proper and reasonable degree of home rule for our American cities.

GERMAN PRACTICE WITH DITCHES AND GUTTERS.

By Robert Grimshaw, C. E.

For roads outside of cities and towns the usual practice is to face the slopes and bottoms of side-ditches with grass, by starting a growth by sowing grass seed on a thin layer of vegetable soil spread thereon for that purpose. Where it is to be feared that this will not give sufficient resistance to washing out, then sodding is resorted to. Where the slope is very steep, paving is employed, especially where the ditch or gutter has but slight fall, and a loam facing is not sufficient protection. Such paving is often of small stones set in an impermeable layer of clay; but where the side-ditch partakes of the nature of a rapidly-flowing brook, as in some instances, wide stone slabs are used. Such stone-paved half-gutters half-brooks may be seen in the town of Loschwitz on the Elbe, just above Dresden, where the fall is very great and the volume of water from melting snow in spring would channel out anything but flag-stone work. The leaders which cut crosswise of the slopes and discharge into the side-ditches or gutters proper, may be given a wedge-shaped cross-section, but must be well-paved or otherwise protected against washing out and local sliding. This is usually provided for by paving or mason-work, in steps so as to give a good grip on the underlying soil.

In city and town, underdrainage of the roadbed is seldom attempted, but sufficient care and attention are given to the gutters to take care of all surface water. Where there is but little width to spare, a common practice is as shown in Figs. 1 and 2. In the former, no special form of stone is used; in the latter, a special gutter-shaped or trough-shaped stone is employed for the bottom. This calls for shallower curb-stones than where ordinary narrow blocks are used as in Fig. 1, as the curb may rest on the edge of the trough; the two breaking joint lengthwise. For asphalted streets it is usual to form the gutter of the same material as the road face. Where vehicles run across the footway as in entering a court yard, stable, etc., either the curb is cut down to the level of the road surface for the width of the car-

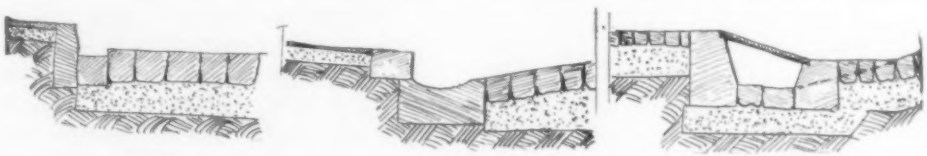


FIG. 1. FIG. 2. FIG. 3.

riage way, or a flat shallow place is made in the footway to permit the vehicles to pass, or, as both these methods make the footway more difficult and inconvenient to travel, the gutter is bridged over with iron plates as in Fig. 3.

THE QUESTION DEPARTMENT.

[By Charles Carroll Brown, M. Am. Soc. C. E., for MUNICIPAL ENGINEERING.]

LIABILITY FOR DEFECTIVE SEWER CONSTRUCTION.

Will you kindly inform me, through your magazine, as to the liability of a city for improper sewer construction, the conditions being as follows: A district or lateral sewer was constructed some years ago through a residence district, sparsely settled, and the cost thereof assessed to the abutting property. The vacant lots have since been improved by the erection of residences and it is found that the sewer is not of sufficient depth to drain cellars of ordinary depth, thus causing much difficulty in operating heating plants. Said sewer is constructed on a grade of 3 per cent. from the main or intercepting sewer. One-half of one per cent. would have been ample. To be of service said sewer must be lowered. To whom should the expense be charged? Is a corporation liable for the blunders of its city engineer? *Subscriber.*

The state of affairs described in the question occurs so frequently that there have been several decisions upon the matter. The principle upon which they are all based seems to be that humanity is very likely to make mistakes, and that when honest mistakes are made in city affairs their correction can not be required of the official making them, nor even of the city itself at the demand of an aggrieved individual. The correction must be made in the manner prescribed by law, and the assessment of the cost is made in the same manner as new work or regular repairs. In some cases the city has assumed the correction of such mistakes, but the weight of authority seems to be that it can not be compelled to do so. If there is evidence of fraud the case is quite different and additional considerations enter into the formation of a decision.

It would very frequently be impossible to decide whether a given line of action was a mistake or not. Frequently what is correct at one time is quite erroneous at another. This might easily be so in cases similar to the one cited in the question.

We must all take our punishment for mistakes made, and no one does so oftener than the city corporation, but it can not be held fully responsible for all the errors of all its officials and employes.

It is usually easy to determine the question of fraud. When this enters it is usually possible to punish the wrong-doer and sometimes to hold the city responsible for his deeds, on the principle that the city is acting for the property-owner or voter, but this is not always true. Each such case must be decided on its own merits. The following item from Milwaukee, under date of Feb. 17, states the view the courts usually take of the matter:

"Judge Ludwig has rendered an important decision in the suit brought by John Folk against the city for damages for his daughter's death. The daughter was a pupil at the seventeenth district school and was taken ill, so it is alleged, from sewer gas in the building. After an illness of ten months the child died. The father thereupon brought suit to recover $5,000 damages. The city entered a demurrer

and this has been sustained by Judge Ludwig. The court holds that the schools are maintained for the public good, and the city can not be held for the negligence of its servants because of the absence of legislation bearing on the point. The case is so important that it will probably be taken to the supreme court."

The only remedy for the tax-payer is one which affects the next time and not the past. If the tax-payers and voters demand a system of management of public works which will secure competent men and retain them when found, they can secure it. But so long as they believe or act as though they believed that public office is to pay political debts and fitness is a secondary consideration, the party in power will choose men for their political aid, or affiliation at least, and remove those of the other party who are found in office after its defeat at the polls. The voters are really responsible for most of the mistakes made in public work, and very properly should pay the penalty for such mistakes. The establishment of a system which will minimize the number and effect of such mistakes is in their own hands and can be carried out whenever they wish.

HOW AND WHEN CATCH-BASINS SHOULD BE USED IN SEWERS.

Should inlets without catch-basins be used on storm sewers or on combined sewers? Under what conditions? Is there any difference in the silting up of sewers below them? In odors from them?

A. P. F.

The use of catch-basins is assumed to be to prevent silting up of sewers. A catch-basin may be so designed that it catches little of the sediment, and it may be left without cleaning until it ceases to act as a catch-basin. Neither of these is a reason for abolishing catch-basins. On sewers where the velocity in the sewer is equal to or greater than the velocity of the stream in the gutter, which actually carries the debris to the basin, the basin can safely be omitted. Unfortunately there are few sewer systems where this is true. Even when the sewers into which the surface water is discharged directly have sufficient gradient, the outlet sewers are liable to have very little fall. In such cases deposits may occur at long distances from the catch-basins. In such a city as Omaha, for example, there are sewers from which catch-basins may be omitted, and the amount of sedimentation in the sewers will be inappreciable.

But there are others, where the omission of catch-basins will cause trouble from deposits when cleansing storms are few and far between. Deposits from house sewage are liable to occur in the same sewers that require catch-basins, and the deposits of either may be partly removed by the retarded water washing down the temporary dams thus formed, so that observation will find quite similar deposits in sewers with and without catch-basins. But, where such deposits occur, complete stoppages are more frequent the greater the amount of debris carried into the sewer. The question is here one of comparative cost of keeping the sewer clean, and of keeping the catch-basins clean. In a city of hills the sewer may be able to carry away all the sediment, while in a level city it can carry away little or none. Since the silting up occurs in sewers with basins as well as in sewers without, the odors from the sewers due to decomposition of deposits are as objectionable in the one case as in the other. There will be little difference, except that the production of odors after a cleansing storm

will not be so rapid where catch-basins are used.

If basins are not used, the receding storm waters will leave deposits of street debris which will act at once as retarders of flow, while if basins are used, the setting up after cleaning will be a slower process, and the bad odor will be kept back a few days. Observation in a small city having neither catch-basins nor traps to inlets, demonstrates that a cleansing storm removes all odors, and that the new crop is formed in a very few days, in summer. Gradients, except of outlets, might be good, but owing to defective design are not all they should be. Observation in a larger, level city using catch-basins gives quite similar results, the production of odors being retarded some days. They proceed as often from decomposition in the catch-basin as in the sewer. Basins being trapped seldom permit escape of sewer gas to the street.

BIDS ON ASPHALT PAVING AT LOUISVILLE.

I notice by the issue of MUNICIPAL ENGINEERING of February, that among the asphalt paving bids received at Louisville, Ky., the Barber and Alcatraz are the lowest bidders. What I want to know is, did the Kentucky Natural Asphalt Co. bid? The mines of same, I am informed, are about seventy miles outside of Louisville, Ky., in Breckenridge Co., and the deposit is known as the Breckenridge. I am also informed that this asphalt has been laid in Buffalo, N. Y., and, if so, why same could not be laid cheaper in Louisville than the two materials mentioned above?

James A. Mundy, Philadelphia.

The Breckenridge Asphalt Co. submitted bids for the contracts let in Louisville, on January 16th, but they were declared "informal" and were returned to the company, for the reason, as stated by the board of public works, that "they bid upon their own specifications and not under the specifications of the board."

HOW TO OBTAIN FUNDS FOR WATER-WORKS EXTENSIONS.

Will you kindly inform me through your magazine as to the most equitable method of obtaining funds for extension of water mains under municipal ownership? The plant in question has recently been acquired by the city. Hydrant rentals have been abolished and water rates considerably reduced. Extensions are now, and will be from time to time, required.

Subscriber.

This question can not be answered with any approach to accuracy without a careful study of all the circumstances of the case. Short studies of the principles on which assessments are made and should be made will be found in several numbers of this magazine. The question of assessment for water mains is discussed in an article on "Assessment for Sewers and Water Mains," on page 215, October, 1898. Another article on "Methods of Paying for Street Improvements," on page 67, February, 1897, treats of some principles which are also applicable to assessments for water mains. Other articles on related topics will be found on page 179, March, 1897; 154, September, 1897; 38, January, 1898; 94, February, 1898.

In the case under consideration it may be suggested that the works were purchased from the city funds so that objection might be made to special assessments on property which had already paid its share of the first cost in regular taxes, when other property had obtained its water service without such special assessments. It may be true, however, that the property served by the system now in paid so large a proportion of the first cost of the works, on account of its higher valuation, that this objection can be overruled. This may well be so if the system is a new one covering only a small part of the town. The increase in value of property by ex-

tension of water mains warrants a special assessment in most instances perhaps equal to the cost of a pipe large enough to supply the street, say 6- or 8-inch, extra cost of pipe used, also for supply mains to be assessed on the district served or on the city at large. In the present case the amount of such special assessment, if any, must be determined after careful study of all the items in the problem.

(By J. W. Howard, B. L. C. E., for MUNICIPAL ENGINEERING.)

WEAR OF GRANITE BLOCKS NEXT TO STREET RAILS.

MUNICIPAL ENGINEERING MAGAZINE takes such practical interest in street pavements and other improvements that I think you will be interested in a sample of the granite paving blocks which are being removed from next to the rails on a few of the many streets where this kind of injury to the pavements abounds. The block I send you is from outside of the track on West street. The ruts formed on the outside are more injurious than similarly formed ones on the inside.

This block has been down for two years and five months, and is a fair sample of the wear under such circumstances. The general rounding of the surface of the block is also well shown. Can you suggest a method of preventing this excessive wear next to rails? or some method of cheap repairs where the form of the rail is "center-bearing" or "side-bearing," and the street-car companies can not be compelled to take these up and put in flat-surfaced grooved rails?

R. A. C., Dept. Public Works, N. Y.

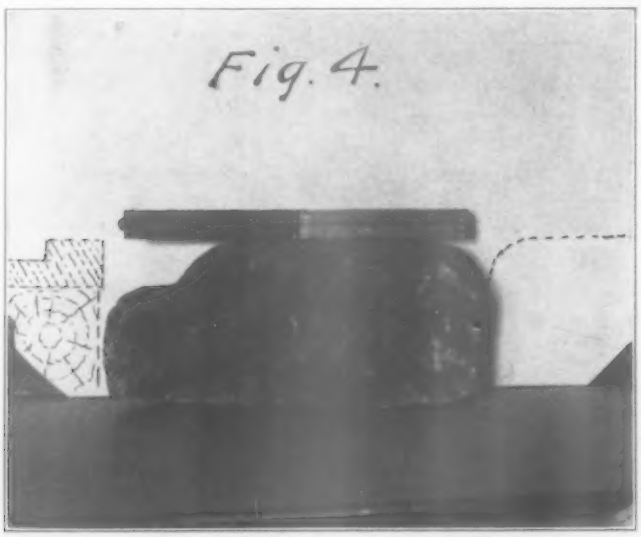
The block you send tells a story which warrants the reproduction of the block by photograph in conjunction with a section showing the relative position of the blocks to different rails. Figure 1 gives a side-bearing rail and Figure 2 gives a centre-bearing rail and worn blocks. Figure 3 is a grooved rail of an approved pattern. Figure 4 gives the photograph of the block you send, with added lines of rail section. The cure is in removing the objectionable forms of rails and of course all wood sup-

Fig. 1.

Fig. 2.

Fig. 3.

ports and the use of deep girder rails with flat surface, except as to the small groove, which suffices to guide the flanges of the car wheels. Economical repairs, which will do away with the evil shown by the block you have sent, are not possible. Injury to street pavements from poor rails, causing annually thousands of dollars of useless expense, obstruction to traffic and street cleaning and general unsightliness, can be as easily corrected in other cities as in European cities, Washington, and a few streets



in two or three others. Detailed information is found in this magazine, volume VII, page 132; volume XII, page 82; volume XIII, page 144; volume XV, page 169, with illustrations.

MOTOR VEHICLES AND BEST POWER.

I desire to purchase and possibly to construct a motor vehicle. Please suggest other sources of power than electricity and gasoline, with their comparative merits; also, give prices asked for those now on the market. *P. R. G., Providence, R. I.*

The method of generating power for motor vehicles for light or heavy vehicles or for both classes, which have passed the theoretical stage and are now in experimental use, without reference to their relative values, but rather in reference to the dates of their appearance, are steam, compresed air, compressed carbonic acid gas, petroleum, naphtha and other petroleum products, electricity and various gases and chemical products, compressed and otherwise.

For use within cities, near electric power stations, electricity seems to be most feasible and will possibly become eventually successful within certain limits of size, weight and radius of operation. For independent motors for general use, away from large centers of population, those operated by the products of petroleum, especially naphtha, promise success, although at present none have fully attained this. With care and intelligent attention they are very encouraging. Under proper conditions in a country abounding in water, the steam road vehicle gives excellent results, but requires expert attention at short intervals. Compressed air, with which extensive experi-

ments have been made for about 25 years, can be used; but probably only with vehicles of excessive weight, expensive to build and operate. We must include the cost of compressing the air at central stations and heating it on the vehicle to make its use possible.

SAMPLE OF BITUMEN.

Kindly publish opinion concerning sample of bitumen, uses, etc.
X. Y. Z., Elizabethport, N. J.

The pliable bitumen you send is interesting, but without your name and address and a larger sample and information likely to be of general use, furnished by you, we can not answer your question, but will try to do so upon their receipt.

ASPHALT PAVEMENT STATISTICS, JAN. 1, 1899.

MUNICIPAL ENGINEERING MAGAZINE has several times furnished paving statistics of interest to us. Can you state the amount of sheet asphalt pavements in the United States and Europe on Jan. 1, 1899?
Contracting Co., Boston, Mass.

Sufficient time has not elapsed to give complete and accurate information, but it is possible from records on hand to give the following statistics of the approximate amount of asphalt pavement in the United States, Canada and Europe on Jan. 1, 1899. At a future date this magazine hopes to publish more complete statistics, showing not only the total amounts in many cities, but also the quantities laid in the different cities during the year 1898.

City.	Population.	Asphalt, square yds.	
Brooklyn	960,000	1,268,000	
Boston	460,000	195,000	
Baltimore	450,000	220,000	
Buffalo	260,000	3,900,000	
Chicago	1,400,000	850,000	
Cincinnati	300,000	380,000	
Cleveland	270,000	95,000	
Detroit	210,000	504,000	
Denver	106,000	372,000	
Indianapolis	110,000	880,000	
Jersey City	170,000	154,000	
Kansas City	140,000	1,100,000	
Louisville	170,000	180,000	
New York	1,900,000	1,600,000	(*a*)
New Orleans	250,000	320,000	
Newark	200,000	591,000	
Omaha	150,000	550,000	
Philadelphia	1,150,000	3,000,000	
Pittsburg	240,000	550,000	
Rochester	140,000	570,000	
St. Louis	460,000,	220,000	
San Francisco	300,000	770,000	(*b*)
St. Paul	140,000	210,000	
Washington	240,000	2,600,000	(*c*)
All United States and Canadian cities (about		26,000,000	
London	4,231,000	400,000	
Paris	2,540,000	450,000	
Berlin	1,700,000	1,700,000	
Other cities		950,000	
All Europe (about)		3,500,000	

(*a*) All except Brooklyn, which see above.

(*b*) Asphaltic sandstone, a local material not equal to requirements of other cities.

(*c*) Including 300,000 Vulcanite. Old and abandoned.

BY WAY OF COMMENT.

Economy of Cement Mixtures.

This may be discussed in respect to the most economical mixture of cement and sand for mortar and the most economical mixture of mortar and stone to form concrete. The former was discussed by Professor I. O. Baker, before the Illinois Society of Engineers, at its last meeting, and the same discussion will appear in the new edition of his book on "Masonry."

When the strongest mortar that can be prepared is needed, there can be no question of relative cost of various mixtures. The strong-

est mixture, as determined by experiment, must be used. Also when mortar of a given strength is sufficient, it is not advisable to increase the cost of the mortar, although the strength of the mortar increases more rapidly than the cost. Sometimes, however, the engineer wishes to take both items, cost and strength, into account and to secure the best mortar at the minimum cost. There is a definite proportion of sand for each individual cement which will give this most economical mortar, and Professor Baker has shown what this proportion is for several cements. We will not anticipate his statement of his results.

This mortar is the most economical when both strength and cost are taken into account. For if the amount of cement is increased the cost of the mortar will increase more rapidly than the strength, while if the amount of cement is decreased the strength will decrease faster than the cost. The results for one cement can not be applied to another of different properties nor can an average proportion of cement and sand be determined which will approximate very closely to the proportion for any cement taken at random. The knowledge of the most economical mixtures for various cements, using the same sand, is therefore of value in determining which cement to use, for a comparison of the cost and strength of the most economical mortars of various cements will show which of these is most economical. This comparison of Portland cement and natural cement mortars has often been made in a general way, and it is easy, and it is sometimes desirable, to make the comparison between two or more cements of approximately the same class. Variations in sand will also make variations in the proportions of the most economical mixtures, but usually they will not be very pronounced. The proportions do not seem to depend directly upon the proportion of voids in the sand.

In considering the most economical proportions of concrete, a third variation is introduced. Our experiments upon the strength of concrete are not yet of sufficient extent to give us much guidance, but there are some theoretical considerations by which we may reduce the field of the unknown somewhat. The strength of the concrete can be varied by varying the proportion of cement or by varying the proportion of mortar. It is ordinarily assumed that the proportion of mortar should be such that the voids in the stone should be completely filled with a small percentage of excess. In the absence of sufficient experiment this mixture is called the most economical. If the proportion of mortar is less, the voids in the stone will not be completely filled and weak places will therefore occur—places where water may accumulate to the detriment of the concrete, especially if there is danger of freezing. If the proportion of mortar is greater, the cost of the concrete will in-

crease more rapidly than the strength, at ordinary prices of materials; with some materials the strength will increase but little, if any. Experiments indicate that the assumptions made are not far from the truth, but additional experimental investigations are desirable.

The other manner of varying the cost of the concrete is by varying the amount of cement, the amount of mortar in the concrete remaining the same. We have little to guide us here in determining the most economical mixture. It is hardly proper to assume that the strength of the concrete varies directly with the strength of the mortar; small reductions in proportion of cement will reduce the strength of concrete little or none, but a point is finally reached (theoretically at least) when further reductions in proportion of cement will produce greater reductions in strength of concrete. This part of the subject is much in need of detailed and well-planned experimental investigation.

Licensing Contractors. The extracts from Mr. J. H. Burnham's paper on licensing contractors, given in our February number, in the report of the proceedings of the Illinois Society of Engineers and Surveyors, show the position which reputable contractors are beginning to take. The fierce competition of recent years has so reduced the prices which can be obtained for work that many honest men are withdrawing from the contest and are leaving the field to those who are yet ignorant of the cost of work, those who fix their prices by guesses, more or less shrewd, those who are successful in justifying bills for extras enough to make both ends meet, and those who by dishonest practices secure the temporary blindness of the proper authorities so that the work is done without regard to specifications in such a manner as to insure a profit where the honest man who lives up to his contract would meet with heavy loss. The first classes met with are transient. We always have them, but they are different individuals. The last we have represented by the same individuals for series of years.

That all work is not done under these unfortunate conditions is indicated by Mr. Burnham's statement that although he made a reasonably good living he did not secure contracts enough in a year to pay his postage on account of being the lowest bidder. This means that honesty of purpose is of some value in some kinds of work and that work is sometimes refused to low bidders whose reputation is not good and is given to higher bidders who have well-earned reputations for doing honest work at reasonable prices.

Mr. Burnham's proposition is an attempt to eliminate the objectionable classes of contractors from all public work, as nearly as regulations can do so, and it is worthy of serious consideration. Action on

some line similar to the one suggested will certainly follow in time. The regulation of contractors by the state has as firm a basis as any other form of the right of the state to protect itself and its citizens from ignorance and dishonesty and will follow the regulation of other trades and professions in due time. It is later for several reasons, the principal one, perhaps, being based on the fact that the needs of individuals are first met, owing to the demands of men of influence and the failure to organize opposition; while the needs of the various branches of the governmental activity open the way for private gain by practices more or less deficient in honesty, which would be prevented by the regulation under consideration.

The individuals interested in continuing the present conditions are those who are attracted to a political life by the opportunities for quiet accumulations, who keep everlastingly at it and are so thoroughly organized that their overthrow is not attainable except during short periods of reform, when honest indignation is fully roused, and before it has cooled.

There is a practical air about Mr. Burnham's suggestions which is attractive and should lead to something definite.

Champaign Septic Tanks.

Professor Talbot's paper on the septic tanks designed by him for the sewerage system of Champaign is valuable as a report of additional observation of the action of the tanks. Further reports, accompanied by statements of definite results, are promised next summer, one of the students at Illinois University being engaged in a detailed study of the results of the action of the tanks. A recent visit to the tanks enabled the writer to corroborate to some extent the statements of the paper. It is evident that bacterial action on cold days (thermometer reading about 25° F. on day of visit), is very slight. This is doubtless due in large part to the admixture of cold ground water with the sewage. The building over the tanks is sufficient, except in the coldest weather, to retard the radiation of heat from the sewage and keep the temperature high enough to allow reasonably rapid bacterial action if the sewage is delivered at its own average temperature. The thick covering of light porous material on the surface is also a good blanket.

The effluent on this day was somewhat milky in appearance and not up to the average of the results from the tank. There was, of course, some objectionable odor when the tank was stirred, but there was none about the effluent nor anywhere outside the building. The small stream of water into which the purified sewage is discharged is ample for dilution in winter. Experience in summer with the tank indicates, as Professor Talbot reports, that the effluent has then much more thorough purification and gives rise to no seriously

objectionable odors, although the stream of water has then disappeared.

For the Champaign sewage an additional section of the tank would probably improve the result somewhat, as the professor suggests. The length of tank and number of surface divisions can hardly be determined in advance of experiments, with our present incomplete knowledge of the action in such tanks of sewage of various rates of dilution. Enough is known, however, to show that such tanks are applicable to many places where some purification of sewage is required, and that the results are obtained at less cost than for other methods in use, from the fact that no attendance is required and that the tanks need to be cleaned a very few times in a year.

When additional purification becomes necessary, the effluent from these tanks is in excellent condition for the application of any of the filtration or irrigation systems at a minimum cost for plant and attendance. Many of the smaller cities and towns need sewers, but the question of sewage disposal is one they have been unable to solve. The septic tank promises such places a reasonably economical method of treating the question. The writer designed such a tank, smaller and without the stop planks for surface currents in 1891, as part of a system of purification intended to be much more elaborate, if circumstances demanded. Though not so well designed as the Champaign tanks, being part of a larger system and not designed for independent action, this tank has done all that was desired, and no further construction has been necessary. The village being a summer resort, the tank is called upon for work in the summer season, and has, perhaps, one-tenth as much sewage to take care of in winter.

Pittsburg Filtration Experiments. The filtration commission of Pittsburg, Pa., has been at work for more than two years upon an investigation of the present water supply of the city and the advisability of submitting it to sand filtration, and a consideration of other sources of supply. Consulting engineers, bacteriologists, chemists of national reputation have been called to the aid of the local talent and quite a thorough study of the problems presented has been made. Some experiments were made upon the waters of the Allegheny river, to determine the best system of filtration for it. The case is very similar to those of Louisville and Cincinnati, and for experimental purposes there were prepared and operated, for about a year, a sedimentation basin, sand filter and three systems of artificial filtration. The report of the commission gives details of the processes and results, and states that preliminary sedimentation is very desirable if not absolutely necessary, sand filtration removes the greatest percentage of bacteria, the efficiency of mechanical filters in this respect can be increased by in-

creasing the amount of sulphate of alumina and the mechanical filters produce the clearest water. The Worms artificial plate filter gave unsatisfactory results. The sand filter increases the temporary hardness of the water, this effect decreasing as the filter gets older. The mechanical filters increase the permanent hardness.

Mr. Allen Hazen recommends sand filtration because that system will show its superiority as the amount of sewage in the water increases, a condition which is bound to occur, while the turpidity of the water will not increase beyond the present maximum. The most serious difficulties are encountered at flood times, when the amount of sediment in the water is excessive. Settling basins or reservoirs are recommended for use at such times.

Mr. E. Kuichling reports upon the cost of a water supply from new sources, estimating it at over thirteen and one-half million dollars, with a third pipe line about 20 miles long, to be built when the consumption exceeds 6,500,000 gallons a day.

The problem of water waste is well discussed and it is shown that the waste is now twice the legitimate consumption. The inevitable conclusion is that a meter system should be adopted. A sand filtration plant will cost nearly two and a quarter million dollars and meters $600,000, making the total cost somewhat less than $3,000,000. The cost of maintenance of the system is not estimated, but it will be materially greater than that of the system reported upon by Mr. Kuichling. The system of sand filtration, accompanied by meters, is recommended by the commission and by all the engineers.

The proposed new supply from relatively unpolluted sources is confessedly limited, so that a complete solution could not be secured in that direction. The supply from the Allegheny is inexhaustible, but the amount of sewage pollution is steadily increasing. The filtration system is able to take out this pollution in a satisfactory manner for an indefinite time. Before the question of sewage pollution becomes very serious, the trend of popular opinion promises to reach the point of requiring thorough treatment of sewage before discharge into a stream used for water supply, so that the increase in pollution of the river can be stopped wholly or in large part.

Philadelphia Water Bureau Report.

Mr. John C. Trautwine, the chief engineer of the water bureau of Philadelphia, in his recent annual report, again expresses his opinion of the peculiar methods of procedure of the city councils and department of public works. The water bureau engineers are the technical advisers of the city upon matters pertaining to the water supply, but their number is cut down to such a low limit that it is impossible for them to prepare the plans and do the supervisory work required of them. They are nevertheless

called upon to produce large and elaborate plans on manifestly too short notice, and when the plans are presented they are likely to be set aside for something proposed by some one interested in transferring the works to private management and which may have been strongly condemned by the bureau engineers. Mr. Trautwine evidently has the courage of his convictions, and is to be heartily commended for expressing them, especially since the present tendency to dishonest manipulation of the matter by the legislative bodies of the city is so strongly suggested, and such reports must therefore be specially objectionable to some of the interested individuals.

Mr. Trautwine is even stronger in his advocacy of meters to stop the present waste of water than the Pittsburg commission, but he is more conservative in his estimates of the saving. He will be satisfied with the saving of half, while the Pittsburg commission predicts a saving of two-thirds of the present consumption, allowing, of course, an increase with the population to offset part of this saving. If both cities adopt the system, they will be such prominent object-lessons of its value that other cities will soon follow.

Connecticut Sewage Disposal Commission.

This commission, appointed by the governor, consists of representatives of various interests, including the engineer and physician, as interested professional men. It has studied the questions of sewage disposal in their relations to Connecticut problems for two years, at a cost to the state for their expenses of $800. Yankee thrift is apparent in the provision by the legislature restricting their expenditures to their actual expenses, thus cutting off expert assistance and advice, and limiting membership in the commission to those with public spirit, time and money enough to be willing to serve—without pay. The commission has made an excellent report, and the substance of its recommendations should be adopted by all states.

They conclude that it is the duty of every community to dispose of its sewage without nuisance; that it should be made easy for communities having common interests in a system of drainage to unite in construction of outfall and disposal works; that discharge of unpurified sewage into any stream whatever by municipal or other corporations or individuals should be strictly prohibited; that it should be impossible to issue bonds or to expend money legally for sewerage until plans for sewers and sewage disposal are approved by competent state authority; that cities already possessing disposal works or hereafter constructing them shall be subject to control in the management of the works so that the effluent shall be satisfactory to such competent authority.

These conclusions are reached after two years' consideration of the local conditions, and of the

methods in vogue in other states and countries, and are those always reached in substance by students of the subject. Other states can accept the report of this commission as authoritative, for it is a statement for their local conditions of principles which are correct and of general application. Much time, money, inconvenience and complaint will be saved by taking up the matter promptly without waiting until serious conditions arise demanding immediate action without regard to expense.

The last legislatures of both Indiana and Illinois had bills embodying these recommendations before them and they are again presented to the legislatures now in session. Without question they should be seriously considered and passed substantially as presented. Both are in practical working form, that of Indiana being the more comprehensive and satisfactory.

We are all slow to move unless our pockets are directly affected. This and a fear in the minds of some that there is a concealed interference with individual freedom of action are the only reasons for the apathy of legislatures on the subject. Neither reason is a good one, and the latter is wholly unfounded.

PERSONAL INFORMATION.

ALVORD—The result of the litigation over the Chicago sanitary district plans was a signal triumph as an engineer for Mr. John W. Alvord, who had general charge of the work of the commission. Mr. Alvord has had extensive and important experience in the municipal field in the West. He commenced his engineering work in 1879 in an apprenticeship covering three years of water works construction and municipal work in Chicago. He was engaged upon the original construction of the Hyde Park water works pumping station and inlet tunnel beneath lake Michigan as well as the sewer system of Hyde Park. Later he became city engineer of Lake View, now Chicago. This position he held for four years, designing and constructing the sewer system, remodeling and enlarging the water works, besides supervising the paving of many miles of streets and doing other municipal work. During the term of his office the population increased tenfold, requiring the organization of all the methods, records and work that go to make a city. After the annexation of Lake View to Chicago, Mr. Alvord spent nearly a year in Europe, examining public works and more especially collecting data upon water supply, sewerage and sewage disposal. Returning to Chicago he opened an office for the general practice of the profession in 1889. During the first year following he designed a sewer system for Cicero, Ill., the township immediately west of Chicago, which, as constructed, ultimately forms a part of the city system. At this time his practice extended to other cities and he commenced the design and execution of water works, sewerage and other municipal work, being called as an expert to the cities of Duluth, Muskegon, Mich., Hurley, Ironwood and other points.

In 1891 he was appointed in charge of one of the engineering departments of the World's Columbian Exposition, having charge of the dredging, grading and filling of the grounds, the construction of the roads and paths. As engineer of surveys and grades, he acted as a clearing house for the plans of all the other departments, having a large force of surveyors and draughtsmen under his charge.

In connection with the fair, he designed and constructed for a private company a water pipe line from Waukesha, Wis., to Chicago, over 100 miles in length, supplying the fair with pure spring water cooled by refrigerating machines and circulated on the grounds to numerous drinking booths.

At the dedication ceremony in October, 1892, Mr. Alvord was presented with one of the seventy medals received by the designers

of the fair, and at its close he was retained to compile the illustrated report of the director of works—a work which occupied a large force for six months and cost over $30,000.

In 1894 he was engaged upon a project for the reclamation of the marsh lands between Jersey City and Newark, which failed of accomplishment owing to the financial depression. Visiting Europe again in the summer of that year, he returned to his old practice in connection with his former partner, Mr. W. S. Shields, the firm having designed or constructed some thirty-five water works and thirty sewer systems for cities and towns of the central West, the most important being a design for the sewage disposal, sewerage and drainage of Columbus, O., made in 1898.

In the fall of 1898 Mr. Alvord was engaged as consulting engineer by the Commissioners of the Illinois and Michigan Canal, and among other duties reported adversely upon the proposed plans of the sanitary district of Chicago for crossing the canal in and near the city of Joliet, Ill. This led to litigation, in the course of which no less than sixteen expert hydraulic engineers were employed on one or the other side, including some of the best known names in the country. The testimony lasted some three weeks and covered a very wide range of engineering problems. The claims of the canal commissioners were, however, fully sustained by the court.

Mr. Alvord is a member of the American, the Western and the Illinois Society of Engineers and is an occasional contributor to the technical journals.

GREENE—Gen. George S. Greene, past president of the American Society of Civil Engineers, died at Morristown, N. J., on Jan. 27, 1899. Although nearly ninety-eight years old, his physical and mental vigor continued until almost the last and he passed away from exhaustion. For nearly seventy years he was engaged in active professional work. His career was a remarkable one. Among the many interesting sketches of his life which have appeared in print is the following, taken from the Railroad Gazette:

"For years he has been an important figure in the affairs of the land and all his life he has stood for much of that which is best in our country. He came of as fine stock as there is in the nation and he represented in his own person an inheritance of ability, integrity and public spirit, which, fortunately, he has transmitted to his sons. His ancestor, John Greene, came from England and settled in Warwick, R. I., in 1635, and there George Sears Greene was born. The descendants of John Greene have been the sort of people who have made the nation strong, the most illustrious of these having been Gen. Nathaniel Greene, who, after Washington, was probably the greatest of the revolutionary generals.

"The descendants of old John Greene who has just passed away embodied the best characteristics of the family. He was a man of unusual physical endowments, not tall, but of powerful frame and great capacity for work and endurance. Within a very few years he could read comfortably without glasses; and he took his part in the work and enjoyments of the societies and clubs to which he belonged, being at upwards of ninety one of the youngest men in any party. His mental vigor was as great as his vigor of body, and almost to the end his faculties remained keen. An interesting story is told illustrating Gen. Greene's endurance and determination. In 1886 he was chairman of a board of engineers appointed to examine the new Croton aqueduct as a result of reports of defective work. Gen. Greene, then eighty-five years old, walked through all of the tunnel under examination, fourteen miles, and was the only man of his party who performed this feat. He took a lively interest in what was going on in the world and remembered accurately the copious details of his long and varied life. His conceptions of private and public duty were of the highest. He was in the best sense of the words a patriot, a citizen, a public servant, a father and friend.

"He was appointed to the military academy at West Point in 1819 and graduated there in 1823 second in his class and was appointed to the artillery. He served in the academy some time as instructor in mathematics. In 1836, having reached the rank of first lieutenant, he resigned and went into the active practice of civil engineering. For a time he was engaged in building railroads, and in 1856 became connected with the Croton aqueduct department of New York City. Here, among other things, he designed and built the reservoir in Central park, and he also designed the enlargement of High bridge. In 1867 he was appointed chief engineer and commissioner of the Croton aqueduct department, where he remained until 1871, when he went to Washington, D. C., as chief engineer of public works, and there he stayed for two years. Since that time he has always been more or less occupied with consulting engineering work.

"Early in the civil war General Greene went into the field as Colonel of the Sixtieth New York Infantry. He was quickly made a Brigadier-General of Volunteers and com-

manded his brigade at the battle of Cedar Mountain and commanded the Second Division of the Twelfth Army Corps at the battle of Antietam. He distinguished himself at Chancellorsville and again at Gettysburg, where he held the right at Culp's Hill. In the fight of the second day the troops had been withdrawn from the right to reinforce other parts of the line, leaving the works on our extreme right empty, and General Greene, who was left to hold Culp's Hill, then the right of the line, found himself in a very critical position. There was imminent danger that the enemy might turn the right and the results of a successful movement of that kind would probably have been very disastrous to the army. In Gen. Doubleday's story of the Gettysburg campaign, he says that Greene 'swung his right around at right angles to the line and entrenched it. Greene was an accomplished soldier and engineer, and knew exactly what ought to be done and how to do it. He held on strongly.' In fact, he held that position with a very thin line and no reserves, and it is not too much to say that Gen. Greene's promptness and skill and determination had a good deal to do with our ultimate success at Gettysburg. In September, 1863, he went West and at Wauhatchie, Oct. 28, he was severely wounded in the face. In January, 1865, he was able to return to active duty and joined Gen. Sherman's army in North Carolina and remained in command of a brigade until after the surrender of the Confederates. He was brevetted Major-General of Volunteers March 13, 1865, and mustered out April 30, 1866. As he had no rank in the regular army he could not be retired, but in 1894 a special act of Congress was passed giving him the rank of First Lieutenant, which he had held in 1836 when he resigned from the army, and putting him on the retired list with that rank, which was always a gratifying fact for the General. It was one of the comforts of his old age that he was restored to the list of the old army.

"General Greene became a member of the American Society of Civil Engineers in 1852, being, in fact, one of its founders, and frequently held office in the Society and served from November, 1875, to November, 1877, as its President, and in 1888 he was made an honorary member of the Society, being one of only thirty-one men so honored. He was for thirty years a member of the Century Club, and was one of its most appreciated and beloved members. He was President of the New Yerk Genealogical and Biographical Society for a number of years and was connected with other learned and scientific bodies.

rimac, and took command of the ship after Worden was wounded. Another son is George S. Greene, Jr., who was for 22½ years Chief Engineer of the Dock Deparment in the Navy, who was in command of the turret of the Monitor in the fight with the Mer-

"One of his sons was S. Dana Greene, of New York City and is still an active and distinguished engineer in civil practice. Another son is General Francis V. Greene, who was an honor graduate of West Point and is famous as a soldier and successful as a business man. Still another son is Major Charles T. Greene, U. S. A. (retired), who lost a leg at Ringold, Ga."

Personal Notes.

John W. Payne has been appointed city engineer at Akron, O.

C. M. Slocum has been re-elected city engineer at Springfield, Mass.

T. Howard Barnes has been appointed city engineer at Medford, Mass.

A. H. Robinson has been elected president of the water board at Lawrence, Mass.

Geo. W. Hager has been appointed a member of the water commission at Marquette, Mich.

Herschel Roberts has resigned his position as deputy state engineer and surveyor of New York.

C. H. Keefer, Ottawa, Canada, has been appointed engineer of water works at Hintenburg, Canada.

J. T. Brown has been appointed street commissioner and superintendent of water works at Pendleton, Ore.

Alfred L. Maggi has been elected city engineer and George E. Mitchell water commissioner at Chelsea, Mass.

Clarence W. Marsh has opened an office as civil engineer and consulting engineer at 489 Fifth Avenue, New York City.

Ernest W. Bailey has been appointed city engineer and William F. Hall a member of the water board at Somerville, Mass.

H. R. King, consulting electrical engineer, Detroit, Mich., has returned home after an absence of six months in Venezuela.

Christopher Harrison has been elected city engineer and George E. Tolman a member of the board of public works at Everett, Mass.

Prof. J. B. Johnson, M. Am. Soc. C. E., has been appointed dean of the College of Mechanics and Engineering of the University of Wisconsin.

Captain Til Huston, Second Regiment U. S Volunteer Engineers, stationed at Havana, Cuba, has been appointed Superintendent of water works of Havana.

Nathanial Roberts, M. M. Sec. C. E., designing and consulting engineer, has just removed his office from 120 Liberty Street to the Bowling Green building, New York City.

Herr Wesselman, of the Wesselman Machinery Company, Berlin, Germany, is visiting the United States for the purpose of purchasing machinery, machine tools and other supplies for the company. His address is the Belvidere House, New York City.

Martin Lipps, contractor, New York City, died Jan. 26, aged thirty-eight years. He constructed the pipe lines at Syracuse and New Rochelle, N. Y., and Waterbury, Conn., and was engaged upon the Croton water supply of New York City.

James L. Tighe has been appointed city engineer of Holyoke, Mass., to succeed John J. Kirkpatrick.

Thomas P. Donough has been appointed engineer of track elevation, to succeed Theodore Buskirk, resigned, at Chicago, Ill.

Desmond Fitzgerald, Boston, Mass., president of the American Society of Civil Engineers, and Rudolph Hering, M. Am. Soc.

Arthur J. Rockwood of Guthrie & Rockwood, Buffalo, N. Y., has been appointed division engineer of the western division of the Erie canal.

Elon H. Hooker, Rochester, N. Y., has been appointed deputy superintendent of public works of New York to succeed P. J. McWheeney, resigned.

George S. Morison, past president Am. Soc. C. E., New York City, delivered a lecture on "Masonry" before the students of the Rensselaer Polytechnic Institute, Troy, N. Y., Feb. 8.

F. W. Cappelen, M. Am. Soc. C. E., who until recently was city engineer of Minneapolis, Minn., will open an office as consulting engineer. G. W. Sublette succeeds Mr. Cappelen as city engineer.

J. N. Hazelhurst has resigned his position as engineer to the board of public works at Tampa, Fla., and has been succeeded by Fred Warren. Mr. Hazelhurst will accept a position on the water works at Mobile, Ala.

Ignacio M. de Varona, M. Am. Soc. C. E., engineer of water supply for the borough of Brooklyn, N. Y., who has been a fugitive from Cuba since the Ten Years' War, has obtained a leave of absence and will return to his home in that country.

Irving T. Farnham, C. E., for a number of years assistant engineer in charge of boulevard and grade crossing work in Newton, Mass., has been appointed principal assistant to the chief engineer of the Massachusetts Highway Commission, with headquarters at 4 Mt. Vernon St., Boston.

C. E., New York City, have been appointed by Mayor Dodge of Worcester, Mass., to act with F. A. McClure, city engineer, as a commission of experts in preparing a report of the best method of abolishing the grade crossings in that city.

James Stuart has been appointed water commissioner at Winnipeg, Man.

James Stuart, ex-alderman, has been appointed water works commissioner at Winnipeg, Man.

William H. Hillery has been appointed superintendent of streets, to succeed John H. Shifferens, at Buffalo, N. Y.

Col. Park Woodward has been re-elected superintendent of water works, and W. R. Dimmock secretary of the water board at Atlanta, Ga.

Herbert Lee Weston, C. E., who was associated with Emmett Smith, city engineer of Bayonne, N. J., died in that city Feb. 7, aged forty-nine.

A. C. Wetherbee has been elected superintendent of the water and sewerage works, to succeed his father, the late W. S. Wetherbee, at Rome, N. Y.

The prize offered by the Cosmopolitan Magazine for the most able article suggesting a scientific, economical solution of handling the wires and gas, water and drainage pipes in great cities and towns has been awarded to Henry E. Bryant.

Arthur J. Cox of the Iowa Engineering company, Clinton, Ia., accompanied by Civil Engineers Dey and Reynolds, sailed for Cuba Feb. 18, where they will examine into several large engineering enterprises. They will be absent until April 15.

Arthur S. Tuttle assistant engineer in the department of water supply, Brooklyn, N. Y., lectured before the institute department of engineering Feb. 17 on "Underground Water Supplies." The lecture was illustrated by fifty views of wells in London, England; Saylesville, R. I.; Foxborough and Lowell, Mass.; Madison and Ft. Hancock, N. J., Nevada, Mo., and Long Island.

TECHNICAL AND TRADE MEETINGS.

Subjects Considered by the Illinois Engineers.

The proceedings at the closing sessions of the Illinois Society of Engineers and Surveyors, held after the last issue of Municipal Engineering had gone to press, embraced among other matters of interest a report of the committee on municipal engineering, submitted by the chairman, Mr. J. W. Alvord, which stated that an important matter has been the working of the act of the Legislature of July 1st, 1897, governing local improvements. The very radical changes introduced by this act, both in method of originating improvement and in their control, has been watched with interest during the past year and a half. There can be no question but that the practical working of the act has been to very largely curtail local improvements since it has been in operation. The committee stated it was convinced that while the law may be proper in the main for cities over 25,000 population, for cities under that number and especially for cities below 25,000 population it should be amended.

One point of interest noted in connection with the office of city engineer was the rapidity with which this position in the state is filling up with trained graduates of technical institutions, largely, of course, from the Illinois state university. The entrance in large numbers of these wide-awake, active young men into such responsibilities cannot be underestimated in contemplating the future possibilities of this class of work taken in connection with the growing tendency to get together and compare notes. "It is too much to hope," said the committee, "that another ten years will raise the

standing of the profession in the smaller cities to the front rank."

Another valuable paper was by W. H. Rosencrans, City Engineer of South Bend, Ind., giving "Some Details of Modern Street Railway Construction." This paper is published in full elsewhere in this number.

One of the important papers was by Prof. Chas. W. Tooke, of the law department of the University of Illinois, on "The Relation of the Constitutional Limitation of the Financial Powers of Municipalities to Public Works."

A. C. Loomis presented a paper on "A Central Hot Water Heating Plant." He said in part:

"About five years ago Mr. H. T. Yaryan of Toledo, O., while interested in the workings of electric stations noticed the large amount of exhaust steam escaping even after the boiler water had been warmed. He followed this up and obtained a patent on a system of heating water by the exhaust steam from a generator of electricity and pumping the hot water through pipes for heating purposes. The first plant was installed in Toledo in 1895, the fifth in Mattoon late in 1898, of which the following is a description in part: Pipes are laid in alleys, the franchise can be annulled for fifteen days' failure to furnish heat, the city buildings are furnished with heat. The heat is automatically regulated in this plant by a thermometer operating a pneumatic valve which in turn opens or closes a valve in the water pipe. Drawn iron pipe with threaded couplings are used. A feed pipe progressively diminishing in size and a slightly larger return pipe are laid in parallel lines. Each is wrapped in asbestos in a double wooden box. The feed pipe as it leaves the station is six inches in diameter. Building connections are one-half inch pipe, one-inch pipe being used inside the building. At present there are nineteen buildings on the circuit and the exhaust steam from a 10-horse power engine would be sufficient to do the work. The water is pumped under pressure of about 30 pounds, it goes out at about 185 degrees and returns at about 80 degrees, both these temperatures being subject to great variation as desired. Live steam can be used when necessary. Patrons are offered heat at a rate less than they pay for hard coal, but not as cheaply as they can use wood or bituminous coal, but the freedom from dust and the greater safety from fires should be taken into account. The long distances the heat may be carried (four miles in this case) gives a large territory for usefulness and commercial profit. The system is yet young and is giving universal satisfaction. It is understood that the patent does not cover the use of other combinations than the electric lighting station and heating plant."

D. W. Mead, chairman of the committee on sanitary legislation, submitted a bill which had been prepared by the state board of health. It is copied after the Massachusetts law and will be presented at the present legislature for enactment. Its idea is to place under the control of the state board of health the water and sewer systems of the different cities. The society indorsed this bill, and, in explanation, said: "The present conclusion of medical authorities is that polluted water supplies and improper disposal of sewage are responsible for many of the diseases of mankind. The development of the state is rapidly increasing the pollution of the streams and other sources of water supply without restriction. Sanitary science has demonstrated that it is possible to prevent, or to rectify, such pollution. The state is the only authority which can regulate the matter, and the state board of health is the executive officer of the state in sanitary matters. Many cities and smaller corporations, desiring to take the right steps in providing water supply and sewerage, need the advice and the authority of the sanitary authority of the state in establishing their line of action. These are some of the many reasons which the society gives for wishing to commit itself to an unreserved and strong support of the proposed bill."

The committee on water works, Charles C. Brown, chairman, presented a report including (1) Some notes on the improvement of a railroad water supply from wells and galleries; (2) a large table showing in detail the cost of pumping in large plants, with some data on small plants. The speaker called attention to the deficiencies of the table in this respect and asked for additions; (3) forms of water works reports, being the forms prepared for the Am. Soc. of Municipal Improvements, published in Municipal Engineering Magazine for November, 1898, and January, 1899.

The committee on good roads reported favoring the passage by the legislature of a bill to provide for good roads, the cost of which shall be paid by the state, county or town assessment, according to property to be benefited. State prisoners are to be constantly employed in building these roads.

Mr. Tarrant read a paper on "Concrete Curb and Gutter." He cited the specifications for curbing in Champaign and Urbana and gave a list of the exhaustive tests for the materials used in the construction of curbing.

The "Economics of Cement Mortar" was fully explained by Prof. Baker, who presented a number of charts to illustrate the many prominent points in the paper.

"The Working of the Septic Tank of the Champaign Sewerage System," by Prof. A. N. Talbot aroused much interest among the members of the society.

A. D. Thompson, C. E., Peoria, was re-

elected to the presidency of the society and J. A. Harmon of Peoria is continued by the executive board as executive secretary and treasurer.

Mechanical and Sand Filtration.

The New England Water Works Association held a meeting at Boston Feb. 8. The subject discussed was "Mechanical and Slow Sand Filtration," which was opened by George W. Fuller, chief chemist and bacteriologist. Slow sand filtration, which Mr. Fuller terms the English system, was introduced in England seventy years ago and has been generally successful there and throughout Europe. To the eastward in Europe there are indications that this process is unable to cope with the turbidity of some of the streams. In America the turbidity of the streams increases to the westward, and simple filtration becomes inadequate after leaving the comparatively clear waters of the East. In extreme cases the turbidity of western waters is caused by clay particles 1-100,000 of an inch in diameter, or 0.1 the size of water bacteria. In slow sand filters this clay gives rise to turbid effluents and penetrates the sand sometimes almost to the bottom of the bed, tending to change the character of the filtering material. It was thought at Cincinnati that the penetration of the clay was partly due to the absence of a layer of organic matter on the surface of the beds, and also to the absence of a film of it on the sand grains. The organic matter in the turbid water was so stable in composition that no vitrification took place with turbid waters. A modified system of slow sand filtration was therefore adopted, in which filtration was precluded by subsidence and coagulation. Mechanical filtration was originally adopted to clarify water for industrial purposes. It is especially adapted to western waters, both in point of efficiency and cost, while slow sand filtration seems more applicable in the East. More study is required to tell whether eastern waters can be readily treated by mechanical filtration. It requires less skill in operation than slow sand filtration. Future investigations will probably be chiefly to determine what modification of either slow sand or mechanical filtration is needed, where either of these systems alone is sufficient, rather than to aid in deciding between the two. The prime essential to the successful operation of purification plants is efficient management.

The Iowa Engineering Society.

The eleventh annual meeting of the Iowa Engineering Society, which was held in Iowa City, was the best, in value, interest and attendance, that has been held. The following topics were presented and brought forth much valuable discussion: "Advantages of the Metric System and Measurements;" "How to Succeed;" "The Retracing of a Government Survey;" "Some Experiments Relating to Standard Methods of Testing Paving Brick;" "The Chemistry of Water;" "The Bacteriology of Water;" "The Uses of Cement;" "A Study of Methods of Water Measurements;" "A Photographic Study of Fire Streams;" "Relief Map Construction;" "Methods of Purifying and Sterilizing Water."

The society expressed itself as in favor of the adoption of the metric system of weights and measures and appointed a committee to study the subject and to report at the next meeting. A committee was also appointed to take up the matter of standard tests of paving brick with the National Brick Manufacturers' Association.

A discussion on "The Advisability of Legislative License for Engineers" was opened by a prepared paper from Prof. Williams of Cornell college. This discussion aroused a great amount of interest, as it is a topic that has been before the society for some years. The idea finds many friends in the society, and strong hopes are entertained that the coming year will witness practical results along this line.

This meeting, held in the buildings of the State university, was especially interesting in its environments, and the welcome and interest of the university added materially to the value and pleasure of the convention.

The following are the officers for the coming year:

President—C. S. Magowan, Iowa City.

Vice-President—M. L. Newton, Waterloo.

Secretary-Treasurer—E. P. Boynton, Cedar Rapids.

Directors—C. R. Allen, Ottumwa; Anson Marston, Ames.

National Brick Manufacturers' Association.

The thirteenth annual convention of the National Brick Manufacturers' Association met in the Assembly Hall of the Great Southern Hotel, Columbus, O., Feb. 7. Officers for the ensuing year were elected as follows: President, W. D. Richardson, Shawnee, O.; first vice-president, Frank B. McAvoy, Philadelphia; second vice-president, W. H. Hoagland, Cayuga, Ind.; third vice-president, W. G. Titcomb, Providence, R. I.; secretary, T. A. Randall, Indianapolis, Ind.; treasurer, John W. Sibley, Coaldale, Ala. Prof. Orton, Jr., called attention to the fact that by the retirement of Anthony Ittner, of St. Louis, from the committee on

technical investigation, a vacancy would occur which must be filled. This committee is composed of five members, one man to be elected each year. Mr. Ittner was named for re-election to serve a term of four years and was unanimously elected. An invitation to hold the next meeting of the Association in Cincinnati was referred to the Executive Committee. Two of the papers presented were "A New Method of Testing Paving Brick," Gomer Jones, city engineer, Geneva, N. Y.; "The Evolution of Paving Brick in the United States," H. A. Wheeler, St. Louis. The committee on trade relations approved the system of recording the service of pavements in the city of Minneapolis, and recommended to other municipalities the adoption of a similar system.

Road Tests of Bicycles.

At the regular meeting of the Civil Engineers' club of Cleveland, on Feb. 14, Prof. Robert H. Fernald read a paper entitled "Experiments on the Efficiency of Bicycles," describing investigations made at the Case School of Applied Science and giving certain conclusions arrived at. Comparisons were drawn between chain and chainless bicycles, racing and road wheels, between sprockets of different sizes, and between tires under different air pressure. Diagrams showing relative efficiency were exhibited. Prof. Fernald stated that the experiments would be continued and others made under road conditions, the duration of cone and ball bearings would be tested and the effect of vibration on frames and the efficiency of different grades of tires at different velocities. The subject was discussed by Dr. Langley, Prof. Benjamin, Mr. S. T. Dodd and others.

Notes of Technical Meetings.

At the twentieth annual meeting of the Ohio Society of Surveyors and Civil Engineers officers were elected as follows: President, E. A. Kemmler, Columbus; vice-president, W. H. C. White, Warren; secretary-treasurer, Prof. C. N. Brown, Columbus; board of trustees, J. M. Harper, Cincinnati; J. L. Gilpatrick, Granville; J. D. Varney, Cleveland; J. C. Cronley, Lima; J. B. Weddell, Mansfield.

The Louisiana Engineering Society has elected officers as follows: President, T. L. Raymond; vice-president, C. H. Chamberlain; secretary, J. F. Coleman; treasurer, Alfred F. Theard; director, H. J. Maloche; manager, Col. S. F. Lewis.

The Montana Society of Engineers has elected officers as follows: President, Eugene Carroll, Butte; vice-presidents, M. S. Parker, Butte, and Frank L. Sizer, Helena; secretary and librarian, A. S. Hovey, Helena; treasurer, Forrest G. Smith, Helena; manager, Jas. S. Keerl, Helena.

At the nineteenth annual meeting of the Engineers' Society of Western Pennsylvania officers were elected as follows: President, H. J. Lewis; vice-president, H. W. Fisher; directors, P. T. Berg, Prof. F. C. Phillips; secretary, R. A. Fessenden; treasurer, A. E. Frost.

The Engineers' and Architects' Club, Louisville, Ky., has elected officers as follows: President, Chas. Hermany; vice-president, Henry Vogt; secretary, Marshall Morris; directors, W. M. Anderson, J. M. Johnson, Calvin M. Duke, Webster Gazlay, Soren Thurstensen and Pierce Butler.

The Scranton Engineers' Club has elected officers as follows: President, W. M. Marple; vice-president, C. C. Rose; recording secretary, H. W. Rowley; corresponding secretary, Morgan Davis; treasurer, A. C. Lamont; librarian, A. E. Lister; directors, James Archibald, W. A. May, Charles Farrar.

The Michigan Engineering Society held its twentieth annual convention at Lansing. Officers were elected for the ensuing year as follows: President, J. J. Hubbell, Manistee; vice-president, H. E. Riggs, Toledo, O.; secretary and treasurer, F. Hodgman, Climax.

The state conventions of Iowa and Nebraska will be held in joint session at Sioux City, Ia., March 1 and 2. These conventions will include the third annual meeting of the Nebraska Brick Manufacturers' Association and the nineteenth annual meeting of the Iowa Brick and Tile Association.

At the meeting of the Franklin Institute, Feb. 8, F. H. Newell, hydographer of the U. S. Geological Survey, delivered the second of a series of lectures on the resources of the West, entitled "The Great Reservoirs Constructed for Water Conservation."

The nineteenth annual meeting of the Iowa Brick and Tile Association will be held at Sioux City, Ia., March 1 and 2.

The Brooklyn Engineers' Club held a regular meeting Feb. 9, when Wm. P. Gerhard read a paper on "A Half Century of Sanitation."

The Engineers' Society of Western Pennsylvania held its annual banquet at the Hotel Schenley, Pittsburg, Feb. 9, with 200 members and guests present.

The meetings of the Engineering Association of the South will, in the future, be held on the second Thursday of each month, at the Berry building, Nashville, Tenn. H. M. Jones, secretary.

The Boston Society of Civil Engineers held its annual dinner at the Hotel Brunswick

Feb. 7, after which current topics of engineering interest were discussed.

The Engineers' Club of Columbus held its annual meeting Feb. 4, and elected officers as follows: President, Edward Orton, jr.; vice-presidents, Prof. C. N. Barrow and H. A. Lanman; secretary, H. M. Gates; treasurer, Wm. Michel; directors, J. M. Wolverton and J. M. Bennett.

CURRENT INFORMATION.

Municipal Control of Water Works in England.

An elaborate report regarding municipal control of water supplies, prepared by G. L. Gomme, of the London city council, is given in the London Surveyor. They are classed in three groups—1, county boroughs; 2, non-county boroughs; 3, urban districts. The number of county boroughs is comparatively small, and for this, among other reasons, the information forthcoming in regard to them is more comprehensive than in the case of the other classes of authorities. Of 64 county boroughs in England and Wales, 43 have the water supply in their own control, and in practically every case a surplus revenue remains from the water rates and charges upon water consumers after paying for maintenance and other annual expenditures. Of the series of tables given, the first deals with income and expenditure. The second gives much interesting information as to the various ways in which the surplus revenue is applied. In a number of cases there is a deficit after the payment of loan charges, but as a rule there are special circumstances to account for this. The third table constitutes an analysis of county borough water accounts, deals with capital and expenditure, and subsequent tables set forth general statistics, the terms on which undertakings have been acquired, a comparison of charges made by county boroughs with those made by the London companies, and the system of charges for supplying water to outside areas. Mr. Gomme concludes, from his survey of the actual facts of municipal water supply, that not only do the majority of municipal water supplies yield a surplus of revenue from the water rentals imposed, but that the corporations do more with the revenue derived from the consumers, in the interests of the consumers, than the water companies do. These extra services are as follows:

1. Repayment of debt, and hence a considerable cheapening of the water service as soon as the debt is paid off.
2. Supply of water for municipal purposes, as at Liverpool, Birmingham, Glasgow, Edinburgh, Dundee, etc., and for charitable purposes as at Glasgow and Edinburgh.
3. The security of a sufficient supply both as to quantity and quality.
4. The economical expenditure of capital moneys on the keeping up of works in a high state of repair and efficiency to meet exceptional circumstances.

Wherever Mr. Gomme has been able to make specific inquiries regarding deficit revenue, he finds that there is sufficient explanation afforded by the policy adopted by the corporation in the management of its water supply to show that the deficit, or apparent deficit, is not due to questions of management as between municipal and private supplies, but to different methods of administering the supplies in the interest of the public—methods which the public authority alone has the power to initiate.

In any one case of deficit of revenue shown, Mr. Gomme would hesitate to challenge it as an extra cost to the consumer, and he points out that if it is extra, it is less cost in the municipal rate or there are more advantages to the consumers which the corporation has deliberately decided that it is necessary to provide.

In considering how far the financial results shown by the accounts have been attained by charges upon the water consumer which bear comparison with the charges imposed by water companies, he thinks the object can best be accomplished by ascertaining: (1) whether the corporations have maintained the same charge as that levied by the companies whose undertakings they purchased, whether they have decreased or increased the charge; (2) whether there are services included in the charge which were not included in the companies' charge. Mr. Gomme declares, from the facts he has obtained, that both general rate-payers and water consumers have gained by the transfer of water undertakings from private companies to public authorities, even though in the first instance the rate-payers have had to pay heavily for the transfer. His comparison of the charges made by the London water companies with those made by the corporations of the large provincial towns is given under three forms, as follows: 1, a rough comparison of the scale of charges; 2, the result in respect of houses of particular value, assuming certain extras in each; 3, a comparison of the charge per 1,000 gallons, arrived at by taking the income re-

ceived and the total water supplied by the companies and the corporations respectively. These comparisons show that there are fewer charges for extras, and that in some cases no extras are charged at all; in many cases the charge is itself less than the London charges. The rental upon which the charges are levied is, however, about one-half the rental of London.

The general effect of purchase is summed up by Mr. Gomme under two heads: (1) In respect of works executed by the companies, the creation of a perpetual annuity to the shareholders of the companies at a rate of interest generally higher than the dividends being paid at the date of purchase; (2) in respect of works executed by the municipal authority after the date of purchase, the payment of a low rate of interest and the provision for redemption of capital. The general conclusion is that, according as the purchase was made, early or late, the effect is proportionately beneficial to the public, in spite of the high price paid for the purchase, but it is beneficial in every case.

He considers that the financial effect of purchase is that, although recent cases of purchase are more beneficial to the companies, it has been beneficial to the consumers that the companies' control of water capital has been brought to a close; it has enabled the corporations to proceed with the necessary extension of works at a cost to the consumers very much less in amount of interest paid for capital. Among the general advantages claimed for municipal water works is a smoother administration, as less friction exists between consumers and the administering authority. Consumers pay attention to the rules of the corporation because they are conscious of the fact that the water supply is their own. The special advantages of municipalisation, consisting of services not undertaken by companies, but performed by municipalities for the benefit of the consumers, are thus given:

1. The repair of supply pipes under the pavements and up to the joint inside the premises of the consumer, as at Manchester, Liverpool and other places.
2. The registration of a body of plumbers who do their work to some extent under the eye of the corporation officials, as at Manchester, Birmingham, Nottingham and elsewhere.
3. Facilities to traders and manufacturers using water in large quantities, as at Middlesborough, for example.
4. The settlement of the scale of charges in accordance with circumstances, such as residence, shop occupation, trade purposes, shipping purposes, etc., due regard always being paid to the particular interests of the town.
5. Greater inspection and saving of waste water, to the advantage of the public generally and of the water administration.
6. The keeping up of the works in a perfect state of repair, the repayment of capital, and the economical expenditure of capital moneys.
7. The securing of the necessary pressure to force water up to the highest required point both for fire protection and for domestic use.
8. The securing of the purest and most copious supply.

Regarding municipal water works controlled by the corporations of boroughs, other than county boroughs, it was not possible to obtain information from each individual borough, and Mr. Gomme availed himself of official figures as published in the local taxation accounts for 1895-96. He points out, however, that these are far from complete, as the charge on the water undertakings in respect of interest and repayment of capital is not stated, so that the financial results to each corporation cannot be more than approximately gauged. The information is undeniably useful, however, in showing to what extent the supply of water is now a local government service and the relative importance of the water undertakings of the authorities throughout the country. Of 241 non-county boroughs in England and Wales 139 seem to have a regularly established system of water supply under their control. Mr. Gomme has included only those towns which are known to have the management of their water supply, or which, owing to the fact that they have incurred indebtedness under the head of water works or show a material amount of receipts and expenditure, can be safely assumed as undertaking the provision of the water supply for their areas so far as such a supply is necessary. The importance of this branch of local government work in the hands of these lesser municipalities is illustrated by Mr. Gomme by a comparison of water works receipts with the receipts from other undertakings and from rates and all other sources of revenue. The receipts and expenditures from water works, though second to those from the gas works, form a large proportion of the transactions of these corporations, while the indebtedness of the boroughs in respect of water works amounts to more than one-third of the total indebtedness for all purposes. Mr. Gomme indicates, by means of notes appended to the figures in each case, how these municipal water works came to be instituted; whether by the corporation originally or by the purchase of existing water works in the hands of the companies.

The figures for urban districts are also taken from the Local Taxation Accounts, the same remarks applying in each case. Of 776 urban district councils which existed in 1895-96, 356 appear to have regularly estab-

lished water works for the supply of their districts. A comparison of the work of the councils under this head with the other local government services shows that the receipts and expenditures of the councils in connection with their water works form a very large proportion of the total transactions of the councils; and the loans under this head amount to nearly one-fifth of the loans for all purposes.

Mechnical Filtration Recommended For Cincinnati.

Mechanical filtration, preceded by sedimentation, is recommended by George W. Fuller, chief chemist and bacteriologist for water purification for Cincinnati. The experiments show that slow sand filtration alone would be sufficient for the treatment of the Ohio river water at Louisville during only 134 days in the year; that, combined with three days' sedimentation, this would suffice for only 231 days, or 64 per cent. of the year. The use of a coagulant, sulphate of alumina, and not over two days of sedimentation, with subsequent filtration, is therefore considered advisable. The estimated cost of the system recommended is $9.97 per 1,000,000 gallons, including capital charges and operating expenses, against $10.36 for a "modified system" of slow sand filtration, although either system would effect a satisfactory purification.

A New Method of Thawing Ice in Pipes.

A method of thawing out water in frozen pipes with electricity has bene originated by Prof. R. W. Wood, instructor in physics in the University of Wisconsin, Madison, Wis. He has conducted two successful experiments. He uses the electric current employed for street lighting purposes, and, attaching one wire to the frozen pipe inside the cellar of one house and the other wire to a similar pipe in the adjoining or any other house, thus completes the circuit. A current of about 50 volts is then turned on, heating the pipes and melting the ice within. A "transformer" is used to reduce the voltage, so that the current will not melt the pipes. In one residence 150 feet of frozen pipe was thawed out in eighteen minutes.

Report of the Connecticut Commission on Sewage Disposal.

The report of the Connecticut State Sewage Commission, which has just been published, calls special attention to the process of sewage disposal known as intermittent filtration. Regarding the disposal of sewage in the ocean the report says: "The ocean is not simply a great sink or cesspool to receive the offscourings of the nations and hide it. Nature has no cesspools. As soon as sewage meets salt water the clay or mud flocks together and begins to sink. Sea birds gather what food they can from the solid parts of the sewage and fishes also feed upon it. With the fishes are included all the lower forms of animal life, some of them almost microscopic, which abound in sea water and feed wholly upon the solid matter suspended in it. These all are the ocean scavengers. But the most dangerous and elusive things in sewage, those which are hardest to manage in any system of treatment, are the nitrogenous matters, animal and vegetable, which are not suspended, but are dissolved in the water and are thus beyond the reach of birds or fish or any kind of animal life.

"The algae and other higher forms of aquatic vegetation cannot live in concentrated sewage, but when it is sufficiently diluted they feed upon its dissolved elements, take them into their structure and assimilate them, thus making them innocuous. It is stated that under suitable conditions the algae can decompose volatile fatty acids, indol, skatol and other offensive soluble matters of sewage. (Bokorny, Archiv. Hyg., 1894, 20, p. 281, ref. Jahresber. Ag. Chem., XVII, p. 49.)

"But the soluble elements of sewage, whether concentrated or diluted, are undoubtedly decomposed and returned to living forms by the agency of bacteria living in the sea, The studies of Russell (Botanical Gazette, 1892, XVII, p. 312, and 1893, XVII, pp. 411 and 439) indicate that while the microbes of sewage and of fresh water soon perish in sea water, species of bacteria peculiar to the ocean are found at all depths. Thus, in Mediterranean sea water, from surface to bottom, 3,200 feet, bacteria abound in nearly the same proportion at all depths, below the limit of constant temperature, 280 to 4,200 individuals per fluid ounce from 10 to 150 per cubic centimeter. The sea bottom is inhabited by active bacteria in vastly greater numbers than the water. This bacteria life is indigenous there, being different in kind from that of the water above. Now this bacterial life is believed to depend for its existence on the soluble nitrogenous matter in the sea water, taking energy from the polluted matter and breaking it up into simpler and harmless forms.

"Much remains to be learned regarding the various forms of marine life in their relation to sewage disposal, but we know enough to convince us that the sea is not a mere diluent of sewage; it is no cesspool. It gathers up the wastes of human life, restores energy to them, and returns them to us clean and wholesome.

" 'Ever at toil, it brings to loveliness
All ancient wrath and wreck.'

"Much has been said by some writers of the enormous waste of fertilizing material which is annually poured into the sea in sewage, and attempts are continually made to extract from the filth, which goes to make up sewage, some valuable fertilizer for land. It would be an economy if this could be done without offense or danger to public health, and by suitable arrangements it is possible under some conditions to use sewage directly as a fertilizer, thus cleansing it and securing its fertilizing elements at the same time. But it needs also to be remembered

that fertilizers poured into the sea are not forever wasted; that to a large extent—we cannot judge how large at present—they are again converted into human food, in part directly, without the intervention of vegetation, and are given back to us by our fisheries. Huxley estimated that the annual product of an acre of arable land is the equivalent of one ton of grain or 200 to 300 lbs. of meat or cheese, 'while an acre of sea bottom, in the best fishing ground yields a greater weight of fish every week in the year.' "

Some of the conditions governing the unobjectionable discharge of sewage in running streams are described as follows:

"If the quantity of sewage is relatively small, if the stream is rapid enough to keep its bed scoured and prevent the deposit of solid matter either on the bottom or on the banks, if it does not foul the water supply of any town or city, if the sewage does not make the water unfit for manufacturing uses, if it does not kill the fish in the streams, or taint the air about it, then little or no objection can be raised to the practice.

"But to name these things is to catalogue the evils from which a considerable number of communities in this state are already suffering, and from which they will suffer much more until some of our large cities purify their crude sewage before sending it into our inland waters. Our cities are growing all the time, the quantity of sewage discharged into streams is thereby increased, and the practice which twenty years ago may have been unobjectionable has in many cases become unbearable.

"An impression has become general that our waterways were designed by nature to carry all our sewage, and that centers of population have a prescriptive right to them for that purpose, but the fact that the riparian owner has a right to the waters of the stream, unpolluted by sewage, seems to have been in some quarters entirely forgotten."

The commissioner says: "We believe, too, that clean streams, like clean streets, clean houses, and clean places of amusement, have a great beneficial effect on the general, moral and physical tone and well-being of the whole community, quite apart from any direct effect which is recognized by the sanitarian. Physical and moral cleanliness are closely associated, and either one promotes the other."

The commission offers, in conclusion, its opinion, based on its study of sewage disposal in the state, as follows:

"(1) The disposal of sewage without nuisance is a duty which each community owes to the public. It is a problem to be settled by each community for itself, with such state supervision and control as is necessary in the public interest. In some cases, however, several communities, lying in the same topographical district, may profitably unite in the construction and operation of common outfall sewers or of disposal works.

"(2) No city, borough, or town, which has not now a sewerage system, should be allowed hereafter to build one which will discharge sewage or polluted water into any stream, whether such stream at the time is used by others for sewage disposal or not, nor should private corporations or individuals be allowed to discharge house sewage or excreta into any streams or rivers.

"(3) To insure sewage construction and methods of sewage disposal which will be permanently satisfactory, the General Assembly should not grant to any corporation authority to issue bonds for building, or to condemn land for building, or to build any sewers, or system of sewers, until an accurate topographical survey of the region to be sewered has been made, and together with plans for effective sewage purification before discharging the effluent into any stream, has been submitted to, and approved by, some competent state authority.

"(4) Provision should also be made by which cities and boroughs now having sewage disposal works, or which may hereafter build them, may be compelled by the state to so manage them that the sewage shall at all times be effectively purified before its discharge into rivers.

"The state is now at the parting of the ways. It may leave the whole matter to drift as it will. Our smaller streams will then become more and more polluted, and at last will be so foul during the summer months that private individuals, plagued beyond endurance, will undertake the expense and wearisome delay of lawsuits, and after years of litigation, it may be, will at last succeed in holding up those cities which have most contributed to the defilement and force them to discontinue it and spend hundreds of thousands of dollars in changing their system of disposal. This is what is going on in this state to-day.

"Or the state may take up the matter and seek, without unduly interfering with municipalities or manufacturing industry, to stop further pollution of our streams and reduce the present amount of it in the interest of public comfort and health. Such a policy will need to be framed and executed with great judgment so as always to have behind it the force of public opinion, to be consistent and continuous in its operation, and to be administered with strict impartiality. This course, we believe, the state should adopt."

Important Decision on the Rights of Private Water Companies.

The United States supreme court rendered a decision recently in the case of the city of Walla Walla, Wash., vs. the Walla Walla Water company, in which the rights of private water companies were involved. The city, in its charter, was given broad powers for providing for a water supply by contract or under municipal ownership on a vote of freeholders, but it was prohibited from granting exclusive rights to any company. The city council passed an ordinance in March, 1887, to secure a supply of water for the city of Walla Walla, by which it granted a franchise under certain restrictions to the Walla Walla Water company for the period of twenty-five years. One of the provisions was that, upon the judgment of a court of competent jurisdiction, whenever the company failed in any of its un-

dertakings the contract should become voidable, but otherwise the city should not erect, maintain or become interested in any other water company.

The company accepted and has since operated under that ordinance. After it had been in force six years, however, an ordinance was passed, June 20, 1893, to provide for the construction of a system of water works for the purpose of supplying the city and its inhabitants with water and to authorize the purchase and condemnation of land for that purpose, and the issue of $160,000 bonds to provide the necessary funds. An election was held and the proposition carried. The city claimed that the contract between the company and itself was not binding so far as it forbade the erection of any system of water works other than that of the company. On the ground that it involved the construction of the constitution of the country, the case was carried to the United States supreme court.

The opinion was written by Justice Brown, who ruled that it sufficiently appeared that were the city to erect competing water works the value of the company's plant would be materially impaired, if not practically destroyed. He found that the case, upon its merits, depended largely upon the power of the city under its charter. The ordinance authorizing the contract declared that, until the contract should be voided by a court of competent jurisdiction, the city should not in any way become interested in any water works except the plant established by the company, while the ordinance of June, 1893, provided for the immediate construction of municipal water works; that there was a plain conflict on the face of the two ordinances; the latter clearly impaired the obligation of the former; that where a contract for a supply of water is innocuous in itself, and is carried out with due regard to the good order of the city and the health of its inhabitants, the aid of the police power cannot be invoked to abrogate or impair it; that the contract, stipulating that the city should not erect water works of its own during the life of the agreement was not objectionable; there was no attempt made to create a monopoly by granting an exclusive right to this company and the agreement that the city would not erect water works of its own was accompanied by the reservation of a right to take, condemn and pay for the water works of the company at any time during the existence of the contract; that the sections of the ordinance relating to this subject simply amounted, in the court's opinion, to this: That, if the city should desire to establish water works of its own, it would do so by condemning the property of the company and making such changes in the plant or such additions thereto as it might deem desirable for the better supply of its inhabitants, but that it would not enter into a direct competition with the company during the life of the contract, as such competition would be almost necessarily ruinous to the company, it was little more than an agreement that the city would carry out the contract in good faith.

The city claimed, as a final argument, that the company had failed to comply with its contract to furnish an ample supply of good and wholesome water; that the pressure in the mains was not sufficient for fire protection, domestic purposes, the irrigation of lawns, etc. The court ruled that these claims could not be set up as a defense; that the ordinance provides the manner in which the failure of the company shall be legally established, and the city was bound to pursue this course before taking steps to erect water works of its own; that so long as the contract remained in force the city had no right to establish water works; that the failure of the company to furnish a sufficient supply did not of itself invalidate the contract; it rendered the contract voidable, but not void; the city was bound to procure its nullity before the courts could treat it as void.

The Tindal System of Water Purification.

Water purification by means of ozone has been successfully tried at St. Maur, France. It is the first plant of this character that has been erected, and is known as the Tindal system. The air, before it is made to pass through the volume of water to be purified, is subjected to the action of a high tension electric current obtained from a dynamo similar to those made use of for lighting purposes; the electric current is led to specially designed receptacles where a current of dry air is made to circulate, and it is in these receptacles that a greater portion of the air is transformed into ozone. This ozonized air is then transmitted by means of an air pump to large columns or receptacles known as sterilizers, in which the water to be purified enters at the same time as the ozonized air. In order that each molecule of air should come in contact with at least one molecule of water, and on the other hand to allow time for the sterilization to take place, celluloid plates, pierced with innumerable small holes, have been placed in the sterilizers at every fifty centimeters.

By this arrangement the water is broken up into fine drops and circulates slowly. After leaving the sterilizers the water, in an absolutely pure state, is collected in a small reservoir, whence it is distributed to Paris by means of pumps. The works at St. Maur are capable of furnishing 100,000 meters of sterilized water per day. The cost is less than .14 of a centime a cubic meter, or about .028 of 1 cent.

Relative Rights of Water Companies Using the Same Source of Supply.

The supreme court of Pennsylvania decided, in the case of the Philipsburg Water Company vs. Citizens' Water Company and involving the question of water rights, that where a water company appropriating water from a stream has never condemned the stream or any portion of it, its rights, as against another company seeking to appropriate water from the stream near its source, are merely those of a lower riparian owner.

Power of a Water Company to Change Rates.

The supreme court of Illinois rendered a decision Feb. 17 in the case of the city of Danville vs. the Danville Water company, in which it held that the city has the power to change the rates to be paid the company for hydrants at its pleasure, irrespective of previous contracts or ordinances. This opinion reverses the decision of the circuit court of Danville, which was against the city. Freeport, Ill., has a suit pending which is almost identical with the Danville suit.

A Contractor's Safe Guarantee.

In discussing the question of term guarantees on paving contracts, a prominent contractor remarked to a representative of Municipal Engineering recently that the contractors themselves are primarily responsible for the present state of affairs as regards the guarantee. "Some time ago," said he, "a certain Pennsylvania town laid quite a large amount of brick paving on a six-inch cinder base. The idea was a new one and how well it worked out has nothing to do with this story. Two firms, both of them friends of mine, submitted proposals for furnishing the brick, the one a well-established and thoroughly reliable manufacturer and the other somewhat new in the business. They were present by appointment at a meeting of the city council and given an opportunity to expatiate upon the merits of their respective products. The representative of the prominent firm spoke first and when he had finished there seemed to be little left to be said on the subject of brick in general or the particular contract in question specifically. The second speaker explained that while he had not the prestige of years of experience to aid him he still felt that he understood the paving brick question thoroughly and proceeded to point out the particular advantages to be gained by dealing with his concern, winding up by offering to guarantee that at the end of ten years his brick should in every respect equal any other brick made in this or any other country laid under like conditions. That being before the day of guarantees his proposal was received with great favor and his competitor declining to meet the conditions he was awarded the contract subject to the guarantee. The two salesmen met at the hotel soon after, and the man who lost the contract did not fail to make a few sarcastic observations for the benefit of the man who won it, expressing the hope that the experience he would gain through the following decade might at least be profitable if the contract was not. In reply his friend inquired whether he had himself had a great deal of experience in bidding upon brick paving. Yes, he had. 'Have you ever before bid upon paving brick to be laid upon a six-inch cinder base?' 'No.' 'Do you think you ever will again?' He hardly thought it likely. 'Well,' said the man who didn't understand his business, 'I never before heard of that combination, either, and I rather felt safe in taking the chances on its not occurring again very soon."

Separate Contracts for Street Construction and Maintenance.

An unusual contract for the repair and maintenance of a street was made necessary at St. Louis, Mo., recently. Formerly it was the custom of the city of St. Louis to include in the contract for reconstructing a street the maintenance of it for a period of years. It was believed that the best results were obtained in this manner. The contract which led to the suit was drawn in this way, but certain property-owners refused to pay, contending that the contract was illegal because it placed a part of the cost of maintaining the street on the property-owners, while the law required the city to pay for the maintenance. The contractor sued on special tax bills, and the supreme court sustained the property owners' contention. This decision was in force when the contract for reconstructing Twelfth street was let, and the contract for maintenance had, therefore, to be let separately. Accordingly, the committee on public improvements recommended for passage a bill authorizing the board of public improvements to let a contract for the repair and maintenance of Twelfth street for a period of nine years.

Court Rulings in Michigan as to Defective Bridges.

A recent decision of the Michigan supreme court held that notice to a contractor for the construction of a bridge, who was not an officer of the township in which the bridge was built, that the bridge was not properly constructed, would not be notice to the town of the defective condition of the bridge; also, that testimony as to a conversation held at a supper table during which the contractor of a bridge was notified by a workman that some of the timbers were defective would not be evidence that the bridge was defective; that in the absence of any knowledge on the subject or anything apparent to observation that would lead to a contrary opinion it may be presumed that a township has repaired a weak and shaky bridge after the lapse of a year from the time it was known to be in that condition. It was also decided that in an action against a township for damages to a traction engine occasioned by the fall of a bridge, it was error to exclude testimony as to whether a ten-horse engine and tank full of water constituted such a load as could reasonably have been anticipated by the township in building the bridge.

Street Cleaning in Chicago.

The problem of cleaning Chicago's streets and alleys was considered in a report to Commissioner McGann, Feb. 3, by Assistant Superintendent of Streets Grossette. He says:

"Chicago is rightly termed the dirtiest city in the United States. For this condition much of the blame is laid at the doors of citizens themselves, who, while complaining against existing conditions, forget to add their mite of effort to the task of city cleanliness. A comparison of the number of garbage boxes used in the wards where the poor people live and the sections inhabited by the wealthy shows the latter to present more violations of the law and less appearance of intended co-operation. The amount of money expended by the City of New York in street cleaning as compared to Chicago shows that the eastern metropolis applies the sum of $7,393 annually to each mile of street cleaned, while Chicago endeavors to gain the same results with an expenditure of $170 per mile."

Street Grades.

At a recent meeting of the Western Society of Engineers Charles P. Chase of Clinton, Ia., read a paper on "Street Grades," in which he said:

"The grade of streets is one of the most vital subjects influencing the general appearance and beauty of a city. It is one of the first questions that should be taken up by a growing community, yet much oftener it is the last. Nearly any person who has held a public office can recall some trouble in the matter of grades and long rows of buildings with every conceivable variation in height above the street are a common sight, silent monuments of a lack of foresight and forethought in not having the grades studied out and established before building arrives at any great degree of permanency."

The Value of Engineering Services.

"The position assumed by Municipal Engineering Magaizne, as well as by several other leading engineering publications looking to a better understanding and appreciation of the value of engineering services has my hearty support," said a well known engineer to a representative of the magazine recently. "It cannot fail to meet the approval of every right thinking man in the profession. The fact is we engineers are obliged occasionally to face situations that make life seem a hollow mockery, or nearly so. Some cities and towns large enough, seemingly, to know better, when they need the services of an engineer, go into the open market and buy the cheapest article that can be found, with the general result that a few hundred dollars are saved at the expense of as many thousands which are needlessly wasted. Not only does the incompetent engineer, so-called, receive the blame he deserves, but frequently the entire profession, without discrimination, is saddled with his shortcomings. If I go to a factory devoted to the extraction of teeth without pain, and, in having a tooth drawn, lose a portion of my jaw bone at the same time, I believe I would learn more about practical dentistry in three minutes than I could have learned in several terms in college, and I think I would apply it, too. The man who has spent years in preparing himself to practice the profession of engineering is somewhat handicapped in a competition where price is the first and only consideration. But in a case in which I was recently interested there was a somewhat unlooked for termination of the matter. I was asked to figure upon an important municipal contract in a neighboring city. Inasmuch as I had already done considerabl work there to the complete satisfaction of the officials, and was assured by some local friends that the authorities were anxious I should receive the contract if possible, I went over the field very carefully and named a price which I

felt sure would secure it. I was so badly underbidden it took me a week to recover from the shock, and, though I was offered the work at the lower figure, I was compelled to decline with thanks. My competitor based his fee upon a fixed percentage of the estimated cost of the work. The lowest bidder received the contract at about one-fourth of the engineer's estimate, which was based upon list prices for material and the highest possible charge for labor. When the city found it had been tricked it resisted payment, but being unable to set up a valid defense to the claim, was obliged by the court, which finally adjusted the matter, to pay the bill in full. I am still trying to decide where to place my sympathies, but then it isn't my fight after all, so it doesn't matter."

Property Cannot Be Taxed in Excess of Benefits.

The United States supreme court rendered a decision recently in the paving case of Norwood, O., vs. Baker, in which it holds that owners of property cannot be taxed for improvements in excess of the actual benefits received from such improvements. The court lays down the following rules:

1. The only just basis upon which special assessments for public improvements can rest is that of special benefits to the property taxed; and the exaction from the owner of private property of the cost of such improvement, in substantial excess of the special benefits accruing to him, is, to the extent of such excess, a taking under the guise of taxation of private property for public use without compensation.

2. Where a special assessment is in itself illegal, because it rests upon a basis that excludes any consideration of benefits to the property taxed, proof that it is in excess of benefits is not required in a suit to enjoin its enforcement, as the only appropriate decree in such case is one enjoining the whole assessment, leaving the local authorities to make a new one according to law.

3. Nor is such suit controlled by the principle that a plaintiff must tender or offer to pay what is legally due, before he can obtain relief in equity against an excessive tax, the entire assessment being illegal.

The decision is of importance to all cities where paving and other improvements have been and will be made. If it holds good it is believed that it may invalidate the Iowa assessment law, which assesses by the front foot and not by benefits.

Record of a Rock Crushing Plant at Roanoke, Va.

To the Editor of Municipal Engineering:

Sir—Having noticed in your January issue an account of the workings of a rock crushing plant at Burlington, Vt., I am prompted to report the results of one that this city installed last summer, consisting of a No. 5 Champion crusher, an 18-horse power boiler and engine, together with bins, fencing and two acres of rock, averaging 35 feet in height, at a total cost of $3,000.

The plant was put in operation July 22, and up to February, 1899, the output was 4,664 cubic yards of macadam at a cost of $2,273.80, or 48½ cents per cubic yard.

The maximum daily output is 105 cubic yards; maximum cost per yard for one months' output, 52 cents per cubic yard; minimum cost per cubic yard for one month's output, 43 cents per cubic yard; cost of same class of material furnished by contract, 90 cents per cubic yard; cost of macadamizing streets by city, 20 cents per square yard; as against work of the same class done by contract, 35 cents per cubic yard, and yet there are those in authority who advocate having work done by contract.

J. H. WINGATE,
City Engineer of Roanoke, Va.

Bath Houses and Gymnasia as Municipal Institutions.

In a recent address before the People's Institute, in Cooper Union, Josiah Quincy, mayor of Boston, argued that if the people of a city want cleanliness and to develop their bodies it was better to construct baths and gymnasia with money from the public treasury than to trust to private philanthropy. The providing of baths, he maintained, was just as essential a function of a municipality as the providing of schools. The education of children should be rounded on the physical side as well as on the mental, and public schools, he believed, should be equipped with both baths and gymnasia.

In Boston the first public bath was established in 1866, he said, and until 1898 it was managed by the board of health. Several other baths were established, but all were summer baths. In the last year the public baths were placed under the charge of a special board of commissioners, two of whom were women, and the results of the change were highly gratifying. There were twenty-three summer baths in the various wards, and under the board of health 650,000 people bathed in the season. Bathing suits were given children of school age free, and at one beach suits were given free to adults. Elsewhere 5 cents was charged for a suit and 1 cent for a towel, and the city did the laundry work. Formerly 650,000 bathed in a year, but last season, under the new management, the number of bathers ran up to 1,900,000. There is also a winter bath now.

In regard to gymnasia, Mayor Quincy said that two years ago a gymnasium was given Boston, and this is patronized by children and adult men and women to the number of 800. The city then built another large gymnasium, at an expense of $20,000.

New Publications.

Hydraulic Machinery, with an Introduction to Hydraulics, by Robert Gordon Blaine, M. E. 383 pp. London, E. & F. N. Spon; New York, Spon & Chamberlain.

This is one of the Frisbury technical manvanus P. Thompson. It gives an elementary exposition of the principles of hydraulics and descriptions of the various measuring apparatus devised for the study of hydraulic problems. It then takes up in an elementary manner the theory and action of water wheels, turbines, hydraulic cranes, elevators, engines, pumps, rams, intensifiers, brakes and their appurtenances and adds a chapter on loss in transmission of water power. It is excellent as an elementary text book on the subject, and to obtain a clear idea of the action of the various appliances it describes. It does not pretend to be a guide to their practical construction. It has a large number of drawings, many with scales, giving practical examples of the best practice. It is the only single volume covering its field satisfactory.

Municipal Functions; A Study of the Development and Tendency of Municipal Socialism. By Milo Roy Maltbie. Reform Club Committee on Municipal Administration. 52 William-St., New York.

This monograph of Mr. Maltbie occupies the December issue of Municipal Affairs, the Reform Club quarterly, and it is probable that others will follow on subjects coming within the scope of the work of the committee on municipal administration. It is an interesting and valuable treatise on the municipality, treating the development of the city in different ages and various countries. It discusses briefly the city of today and the problems it must solve, and leads to the author's conclusions regarding the tendency toward municipal socialism, in which there is much suggested for careful consideration.

Management of Municipal Water Works.

In a recent communication to the Toronto Globe, Mr. F. H. Macpherson, auditor of the Windsor Water Works, points out the importance of a distinct separation of the management of municipal water works plants from other branches of the city government. In Toronto and in many other cities the water department is made to bear unjustly a large proportion of public expense that does not properly belong to it, and this in turn falls upon the water consumers. If the management is distinctly separated Mr. Macpherson contends that the rates will be determined according to the cost of the service, without regard to expenses in other branches of municipal affairs. As an instance of this Mr. Macpherson cites his own city, Windsor, where, in 1889, the water works were placed under the charge of a board of three commissioners, who have conducted this department of business independently or other municipal affairs. In consequence, they have gradually reduced the rates until now they are about 30 per cent. below the former schedule and still further reductions will probably be made.

MUNICIPAL REPORTS.

Municipal Reports.

Report of the Operations of the Engineer Department of the District of Columbia for the year ending June 30, 1898. By Major W. M. Black and Capt. Lansing H. Beach, Engineer Commissioners.

This report is of exceptional value, because it contains not only much important data bearing upon municipal problems, but there is much instructive technical discussion in the treatment of subjects embraced in the review.

The commissioners state that sheet asphalt and asphalt block were the only driveway pavements laid in Washington last year. Vitrified block was used almost entirely for alley paving, though in a few instances asphalt block was used. The old tar pavements laid in Washington a few years ago are rapidly failing, and the commissioners say that their general replacement cannot longer be postponed. "This pavement answers the purpose very well during hot weather," they say, "but as soon as the temperature becomes low enough to cause tar to become brittle it goes to pieces with but little more cohesion than so much loose gravel or broken stone."

The commissioners say that it has been found upon further investigation that the statement in the last annual report of the engineer department that asphalt laid over granite block had not given satisfaction in

Washington was erroneous. The report shows that asphalt surfaces have been laid over ten cobble pavements, eight asphalt block, three macadam and two granite block pavements, all of which are now in either fair or good condition, except in one instance where a surface of 1½ inches, with an extra amount of sand, was laid as an experiment over granite blocks for one square on Sixth-st., which is now badly worn. Construction of this kind, it is stated, will not be repeated.

A table is set forth showing the cost of repairs per square yard for sheet asphalt pavements upon six-inch and four-inch bases. In many instances there has been no expense, and the largest is 2.702 cts. per square yard per year after date of laying. The prices paid for pavements last year were: For sheet asphalt, $1.54 to $1.75 per square yard, and for asphalt block, $1.77 per square yard. This year the prices will be: Sheet asphalt, $1.75, and asphalt block, $1.77. The report says:

"Much complaint is made in the city against the granite block pavement, and with very good reason. As described in the report of last year, this pavement is exceedingly slippery in dry weather and at all times excessively noisy. There is no questioning the fact that property interests are injuriously affected by this class of pavement. A residence facing a street of this character cannot be rented for an amount equal to that freely given for a similar house upon a more smoothly paved street. The same can be said with regard to stores, with the additional fact that trade is to a certain extent diverted from such a street. The requests for relief from storekeepers and property-owners throughout the city is general, and it is believed that it is time action should be taken in the matter. One great objection which has existed before to changing the character of these pavements has been that no use was provided in the plan for the blocks removed, and in this manner a large expense would be incurred and the cost of the blocks practically thrown away. Where there were so many streets in the city clamoring for pavement this argument had much force. It is now proposed, however, to utilize the granite blocks in diminishing the cost of maintaining the county roads."

The report states that in Washington heat causes greater damage to cement walks than cold. A new cement sidewalk around the Congressional Library building was subjected to such compression by expansion that a couple of blocks were thrown into the air to a hight of several feet, with a noise like the report of a gun. The best method of protection against this trouble has not yet been determined.

The traffic over many of the country roads in the district is so heavy that macadam is insufficient to stand the wear. The commissioners, therefore, recommend that granite blocks be taken from the city streets and laid on the country roads, in 10-foot strips on each side, with a 10-foot strip of asphalt or asphalt block in the middle. The cost of this construction is estimated at $5 per linear foot.

The total estimate of the cost of the sewage disposal project is $4,029,635. As the average appropriation for this purpose is $128,666.66 per year, it will, at this rate of progress, require twenty-six years to complete the work.

The report contains several very good illustrations, showing the evils of the overhead wire system in Washington and the damage to pipes by electrolysis, which threatens to lead to very serious results. An entirely new system of underground construction is believed to be a necessity of the near future.

Annual Report of the City Engineer of Albany, N. Y., for the year ending January 1, 1899, by Horace Andrews, City Engineer.

With the exception of one block the material used for all the street paving in Albany during 1898 was brick and the city now has thirteen miles of brick-paved streets. Since 1886 one-half of the cobble pavements have been removed. The average price paid for brick paving on eight inches of concrete is $2.10 per square yard. The average cost of granite block pavements has been a fraction less than $3 per square yard and of asphalt laid prior to 1893, $3.15. The sewer construction during the year aggregated only 1.888 miles in length. The Knox-st. viaduct was an important part of the construction work during the year. The city is about to begin the building of a municipal bath house, which, it is expected, will be ready for use next summer.

Second Annual Report of the Commissioners of Water Works, Cincinnati, O., January 1, 1899.

An important feature of the work of the Cincinnati commissioners of water works, noted in the report of the president, Aug. Herrmann, has been the experimental filtration plant on which a separate and special report will be submitted, reference to which is made elsewhere in this number; suffice to say that the experimental plant has demonstrated to the satisfaction of the chemist in charge that mechanical filtration will be necessary at Cincinnati. The cost of the experimental purification plant was $36,680.95. The total expenditures for the year amounted to $417,428, of which $29,635.43 was for preliminary analysis and investigations and $33,210.67 for engineering contstruction. The

chief engineer, Mr: G. Bouscaren, reviews in detail the plans for the new water works system, to which is added much data and a number of diagrams.

Fourth Annual Report of the Board of Trustees of the Water Works and Improvement Bonds of Jacksonville, Fla., Covering the Year Ending Dec. 31, 1898.

The superintendent, Mr. R. N. Ellis, reports the progress of the rebuilding of the Jacksonville water works, which embraces a new pumping station and the removal of the old building, the purchase and erection of two triple expansion, duplex pumping engines of 5,00,000 gallons capacity each in twenty-four hours, two water tube boilers of 200 horse-power each, the removal of the old pumping engines and boilers, the sinking of a 12-inch artesian well, the building of two aerating basins and of a reservoir of 2,400,000 gallons capacity, the erection of a water tower with a storage tank of 238,000 gallons capacity and the extension of water mains and the distributing system 169,592 feet. This improved water supply proved to be of great importance when the United States troops were located at Jacksonville last summer.

Eighteenth Annual Report of the City Engineer of Gloucester, Mass. By Winslow L. Webber, City Engineer.

Mr. Webber's report fully covers the details of his work, which consisted largely of widening and laying out new streets and repaving by day's labor. Street watering in Gloucester has caused much dissatisfaction on account of the assessment, which is computed at the rate of 2 cents per front foot on property abutting on the streets watered.

BALTIMORE, Md.—In his annual report O. W. Connet, assistant city commissioner, says that it is feasible to lay sheet asphalt over cobblestone pavements, giving a smooth surface at a cost of from 50 to 60 cents less per square yard than of ordinary asphalt pavement were laid. He recommends that the city fix a standard price for sheet asphalt pavement and let contractors bid for work on the length of the guarantee. Builders, he says, are using vitrified brick for original paving instead of cobblestones, as they can dispose of property with the street so paved to better advantage.

Assistant Commissioner J. S. Patterson, in his report, shows that about $58,000 was spent last year in the city and annex in making repairs to cobblestone pavements. In the city 1,548,295 square feet of cobblestone paving and in the annex 73,805 square feet, were laid at an average cost of 3 cents a foot.

Assistant City Commissioner Brosius recommends the construction of the Central avenue sewer from Orleans street to the dock, at a cost of about $182,000, and the Schroeder street sewer should be rebuilt, from Pratt to Schroeder, to Lexington, to Arlington avenue, to Saratoga street, at a cost of $100,000. He also recommends the construction of several new sewers.

OSHKOSH, Wis.—The annual report of City Engineer Leach for the year ending Oct. 1, 1898, states that this city now has 13 miles of paved streets, of which more than 10 miles are paved with cedar blocks and the remainder are macadamized. City Engineer Leach condemns cedar block pavement as unserviceable, notwithstanding light usage for a period of only two years. He recommends asphalt, granite block, brick paving, and urges careful building of streets. Of 95 miles of sewers 2.37 miles were laid during the last year. The main pipes are too small to carry off the water from the laterals and it is believed that new and larger pipes will be necessary in a short time.

SYRACUSE, N. Y.—Mayor McGuire, in his annual message, urges the subject of street lighting and contends that the time has arrived for the city to establish a municipal electric lighting plant. He says:

"The people own the water works and should own and operate the electric lighting plant. Water and light are the most important municipal necessities. The people would not submit to the monopolization of the former commodity; why should they be forced to submit to the electric light monopoly? The excuse in the past has been to the effect that the city had nearly reached the bonded limit. This excuse no longer serves, as the city is amply able to issue the necessary bonds for a street lighting plant and a street lighting system."

BUFFALO, N. Y.—The annual report of the department of public works contains a comparison of meter rates for water in thirty-seven cities, showing the amounts which the same consumption would require to be paid in the cities named. Meters are not furnished to private houses in Buffalo, but only to those using a large quantity of water. The minimum meter rate is $24 per year. The meter rates are: For 22,500 gallons each month, 6 cents per 1,000 gallons; for all over 22,500 gallons each month, 2 cents per 1,000 gallon. Most meter rates are by the number of cubic feet instead of by the gallon, hence the oddly selected number of gallons consumed per month. There are nearly 7½ gallons in each cubic foot, so 7,500 gallons in each cubic foot represents 1,000 cubic feet; 22,500 gallons 3,000 cubic feet, etc.

The report says: "There are so many factors which enter into the cost of water in

different localities that it is difficult to get a fair basis of comparison. Where the supply is unlimited water will naturally be cheaper than where it is scarce. Where the water is all pumped by steam power, the price would naturally be higher than where the pressure is obtained by gravity. Even in two pumping systems the distance from mines has an effect on the price of coal, and so pumped water ought to be cheaper near the coal centers than it is where coal is scarce and high. Private and municipal ownership may also have an effect on prices."

INDIANAPOLIS, Ind.—Mayor Taggart submitted to the council Feb. 20 the annual reports of the city government for the year 1898. Improvements were made during the year as follows: Asphalt streets, 5.28 mis., $280,451.76; asphalt alleys, .08 mis., $1,671.46; wooden block streets, 3.88 mis., $174,008.61; wooden block alleys, 19 mis., $3,697.74; brick streets, .93 mis., $19,349.96; brick alleys, 1.24 mis., $16,537.66; macadam streets, 1.50 mis., $56,301.78; gravel streets, 5.13 mis., $57,632.55; gravel alleys, 1.35 mis., $3,275.17; sewers, 16.31 mis., $267,032.48; cement sidewalks, 15.96 mis., $76,972.85; brick sidewalks, .67 mis., $2,501.90; total miles, 52.52; total cost, $959,433.92. The report says: "In regard to permanent street improvements the consensus of opinion of prominent engineers and of the leading engineering journals throughout the country is that asphalt is the best material for street pavements known at the present time, both as to durability and from a sanitary point of view, and on account of the ease with which repairs can be made to the same. While in the number of square yards laid in the past year asphalt greatly preponderated, yet extensive improvements were made with creosoted wooden blocks. The wooden block streets are very beautiful and have become very popular, and, although this form of pavement is said to be very satisfactory in European cities, especially in Paris and London, and in one or two cities in this country, nevertheless, I agree with the opinions expressed by the board of public works and the city civil engineer in their reports that under our climatic conditions the durability of this pavement is still problematical, and that this form of pavement should not be constructed too extensively until it has proven its durability."

ST. PAUL, Minn.—L. W. Rundlett, city engineer, states in his annual report that there are fifty miles of cycle paths in St. Paul and vicinity. Of this nine miles were built last year, exclusive of repairs made upon paths previously built. In former years the paths were maintained and kept in repair by the board of works, and it has been proven that in no other way can a given sum of money accommodate more people and afford better facilities for both pleasure and business travel than in the construction of cycle paths. It has become as much a matter of necessity as a sidewalk on the public highway. To show the advantage of cement over wood he cites that there are now 321 miles of wooden walks and ninety-one miles of cement walks. There was expended on repair for wooden walks a total of $11,136.44; recovered because of personal injuries, $4,469.78; for inspecting the sidewalks, $1,093.25. The repair to cement walks have cost $404.16. The city had at the beginning of the year 10.5 miles of asphalt paved streets, which has been increased to 11.9 miles. These streets are all swept by hand. A sweeper is assigned a certain amount of street, ranging from seventy feet to a half-mile, depending upon the amount of dirt to be removed. The season began with forty-five men and ended with forty-nine working. The actual cost of the sweeping is estimated at $32.14 per mile per week. In addition to sweeping the asphalt streets in the business district were cleaned by flushing. A crew of six men and a single horse were able to wash two miles of streets per night, the cost for labor being $11.80 per night. The average cost for water, line of hose, etc., for the 342 miles flushed was $9.80 per mile. The report says this method of washing was very satisfactory, removing entirely the fine dust which could not be taken up by brooms. City Engineer Rundlett is of the opinion that if the streets in the business district were washed every night there would be no need of sprinkling the asphalt during the day, but the cost would probably be increased to about three times the present cost. As there is no charter providing for making an assessment for this class of work the entire cost is taken out of the street and sewer force fund, and the fund is really too small for the present requirements. The sum of $21,287.83 was expended on sewers, of which 2.47 miles were built. The total cost of asphalt paving during 1898 was $82,657, the average cost per square being $2.06; sandstone, $2.545, or $1.65; brick, $3.360, or $1.40.

NEW YORK CITY.—William Dalton, commissioner of water supply, has submitted his first annual report, which gives a statement in detail of all matters in his department. He states that he has in contemplation the following improvements and additions: Two additional pumping engines of 15,000,000 gallons daily capacity, for the high service station at Washington bridge; a 48-inch main for the west boulevard across Central park to Third-ave., to increase the high service supply east of the park; a high service station and plant at Jerome park, and a 48-inch main thence through the central and southerly sections of the borough of Bronx, to give the much needed increase in supply and pressure of water. He recommends the following immediate improvements: A 66-inch steel pipe conduit from Spring creek to Millburn, 15 miles, $950,000; increase of Millburn pumping plant, $100,000; additional wells, well pumping plant, machinery, lands for sanitary protection of supply, etc., $300,000.

MACHINERY AND TRADE.

The Paving Brick Industry in Iowa and Other Western States.

Statistics gathered by Foster Bain, Iowa's assistant state geologist, show a rapid development of the paving brick industry in the West during the last few years. Returns from 29 cities of the middle West show that a total of nearly 300 miles of brick paving were laid during the period from 1890 to 1897. This does not include all the cities in which paving was done, for there are a number of cities that have not responded to the inquiry for data. Des Moines leads in the list of cities with 51.38 miles of brick paving, others being as follows: St. Louis, 25.13; Peoria, 22.54; Springfield, 20.46; Bloomfield, 18.75; Davenport, 16.14; Chicago, 14.34; Clinton, 13.77; Rock Island, 12.00; Council Bluffs, 7.25; Atchison, 7.61; Beatrice, 7.00; Joliet, 7.00; Oskaloosa, 6.33; St. Joseph, 5.11; Dubuque, 5.00; Sioux City, 4.89.

Considerable difficulty was encountered in ascertaining the prices paid for paving brick, as the schedule varies for the different kinds of work and different grades of paving. The production of paving brick in the middle West in the year 1897, together with prices paid, was as follows:

Rank.	State.	Thousands.	Value.	Price.
1.	Illinois	87,169	$719,371	$ 8.25
2.	Iowa	56,315	426,056	7.57
3.	Missouri	19,620	182,625	9.31
4.	Kansas	17,463	127,600	7.31
5.	Nebraska	3,092	25,169	8.46
6.	Minnesota	530	22,332	11.72

Jeffrey Concrete Mixer.

An illustration is given herewith of the Jeffrey concrete mixer. This is a very simple design, being nothing more than a steel box made of heavy plate, well braced and stayed, with a shaft running through at diagonally opposite corners and mounted in heavy pillow blocks. Power is attached to this shaft, which revolves the steel box, and in so doing thoroughly mixes the material. The box can be made in several sizes, but is usually built from four to six feet square. The mixer is provided with a suitable door, so that it can be loaded conveniently, also emptied when the batch has been mixed. The Jeffrey Manufacturing company of Columbus, Ohio, are the manufacturers of the mixer.

THE JEFFREY CONCRETE MIXER.

Recent Inventions.

(Reported especially for MUNICIPAL ENGINEERING, by Arthur M. Hood, Indianapolis, Ind. Copies of any patent may be obtained for ten cents.)

616,685—Dec. 25, 1898.—Street Sweeper—Arthur P. Palmer and Homer L. Phelps, Athens, Pa.

616,690—Dec. 27, 1898.—Dam for Repairing Breaks in Levees—William H. Schneider, New York, N. Y. assnr. one-half to Frederick T. Ralf, same place. A wedge-shaped structure made of intercrossing logs tied together and piles driven into and through the openings between the logs.

616,897—Jan. 3, 1899.—Dumping Wagon Box—George Caskey, Page, Iowa.

617,055—Jan. 3, 1899.—Street Sweeper—G. E. Schnepper.

617,680—Jan. 17, 1899.—Automatic Regulating Weir for Filters—W. B. Nye, Brookline, Mass., assnr. to New York Filter Manufacturing company of New Jersey.

617,861—Jan. 17, 1899.—Filter—Franklin Agge, Salem and W. B. Nye, Brookline, Mass., assnrs. to New York Manufacturing company of New Jersey.

617,899—Jan. 17, 1899.—Suction Dredging—F. W. Krogh, San Francisco, Cal. A suction pipe, capable of a universal movement, carries at its outer end a vertical pipe upon which is sleeved a cutting cylinder carrying cutters at its lower end.

617,914—Jan. 17, 1899.—Dumping Attachment for Wheeled Scrapers—Anson Titus, National City, Cal. The scoop is pivoted on the axle and provided with clamps which may be thrown into engagements with the wheels.

618,010—Jan. 17, 1899.—Road Grader—J. W. Macy, Searsborough, Iowa.

618,024—Jan. 17, 1899.—Machine for Making and Repairing Roads—M. G. Bunnell, Chicago, Ill., assnr. to F. C. Austin, same place.

Method of and Apparatus for Extracting Bitumen From Sand—Augustus S. Cooper, San Francisco, Cal. In various parts of the United States large quantities of sand, the grains of which are cemented together by bitumen, are found. The principal object of the present investigation is to obtain this bitumen free from impurities at a low cost. The method employed consists in subjecting the material to crude petroleum in order to dissolve the bitumen, in subjecting the mass to the action of a benzin solvent for the bitumen, in mechanically agitating the mass, separating the solution from the sand, evaporating the solvent from the asphalt and returning the solvent in vaporized form to fresh portions of the oiled sands.

617,391, Jan. 10, 1899—Drying apparatus, Frederick Berner, Jr., Indianapolis, Ind.

A rotary broom provided with usual conveyor flight. Inside the flight is arranged a series of plates overlapping each other axially and having a radial space between the overlapping ends.

617,476, Jan. 10, 1899—Dumping wagon, Joseph Blum, Chicago, Ill.

617,605, Jan. 10, 1899—Excavator, W. S. Russell, Toledo, Ohio.

A railway excavator, the peculiar feature of which is that one of the car trucks is carried by a turn-table whose position relative to the car may be shifted.

617,606, Jan. 10, 1899—Drawbridge and locking device, W. L. Sampson, Ocean Grove, N. J.

Two cantilever spans are mounted on tracks so that each may be transversely moved. Each span is provided at its land end with an incline which, when the span is moved landward passes beneath an apron and serves to lift said apron.

617,707, Jan. 10, 1899—Traction ditching machine, J. J. Searcy, Reynolds, and O. S. Martin, Monon, Ind.; C. F. Martin, administrator of Scearcy, deceased.

A rotating cutter wheel carrying a series of cutting buckets on its periphery, means being provided to automatically discharge the buckets.

617,615, Jan. 10, 1899—Concrete arch, Edwin Thatcher, Detroit, Mich.

Metal bars having vertical projections are buried in the arch. These bars are independent and arranged in pairs, one above the other, one near the extrados and the other near the intrados, each bar extending, at its ends, well into the abutment.

617,712, Jan. 17, 1899—Machine and apparatus for extracting and refining asphalt, A. F. L. Bell, Carpenteria, Cal., assn'r to the Alcatraz Company, San Francisco, Cal.

A rotary drum provided with the usual helical and longitudinal vanes. The asphaltic material is introduced through a sealed steam jacketed feed spout and means is also provided for introducing a liquid solvent.

618,095, Jan. 24, 1899—Drier, F. A. Hetherington, Indianapolis, Ind.

Two revoluble drier drums over which are mounted two arc-shaped cover-sections, the inner adjacent ends of which are supported by hangers outside the setting. The two drums are fed through feed spouts, the upper ends of which are brought together side by side so that they may be equally fed by a single elevator.

618,143, Jan. 24, 1899—Dredging machine, Andrew Thompson, Tacoma, Wash.

618,143, Jan. 24, 1899—Means for producing sand beaches, W. L. Averill, Painesville, O.

A series of cribs arranged parallel with the shore and spaced so as to leave free water ways between their adjacent ends.

618,398, Jan. 31, 1899—Fountain, F. W. Darlington, Philadelphia, Pa.

An illuminated fountain with independently movable color-screens arranged so that they may be moved into or out of the path of light each without interfering with any other.

618,495, Jan. 31, 1899—Dumping vehicle, Harry Cooper, San Antonio, Tex.

The body is revoluble about a longitudinal axis.

618,522, Jan. 31—Means for purifying liquids, Dexter Reynols, St. Louis, Mo.

A system of filters having electrolytic action.

618,525, Jan. 31, 1899—Machine for mixing asphalt, H. H. Butler, New York City; assignor two-thirds to L. A. Rockwell and C. S. Fowler, same place.

618,646, Jan. 31, 1899—Electric illuminated clock, R. T. Crane, Jr., Chicago, Ill.

Means for automatically illuminating each figure of the face synchronously with the arrival of the hand.

618,955, Feb. 7, 1899—Caisson excavating, W. H. Gahagan, New York, N. Y.

Water is used for excavating and the water, together with the suspended dirt, is pumped out by means of a pump located in the air chamber of the caisson.

618,956, Feb. 7, 1899—Concrete pavement, A. L. Johnson, St. Louis, Mo.; assignor to the Metalloid Sidewalk Co., same place.

A line of stringers is laid along each edge of the walk and concrete slabs are placed on these stringers, the middle of each slab being free and unsupported, and metallic strips being embedded transversely in the under sides of the slabs.

618,964, Feb. 7, 1899—Filter, J. F. Theurer, Milwaukee, Wis.

A filter unit consisting of a filter body holding-pan having a central hollow hub, and inclined bottom, and holes leading through the walls of the hub, the arrangement being such that the pans may be nested in any desired numbers.

619,965, Same party, similar invention.

619,374, Feb. 14, 1899—Elevating grader, S. F. Welch, Aurora, Ill.; assignor to the Western Wheeled Scraper Co., same place.

A scraper discharging upon an endless elevator.

619,504, Feb. 14, 1899—Combined land grader and roller, J. M. Robinson, Bozeman, Mont.; assignor one-half to Emil Ketterer, same place.

The scraper is automatically raised out of operative position as soon as it is unlocked.

619,581, Feb. 14, 1899—Dredging bucket, H. T. Kromann, New York, N. Y.; assignor one-half to Cornelius Griffin, same place.

A scoop bucket having a hinged bottom with peculiar fastening and releasing means.

619,675, Feb. 14, 1899—Dredge and elevator, A. W. Cram, Haverhill, Mass.; assignor Centrifugal Pump and Mining Co., same place.

A vertical tube in which is mounted an elevating screw carrying cutting mechanism at its lower end.

Trade Notes.

A paving brick plant has been established at Conneaut, O., with L. Harper in charge.

The Henry Correll Lime and Cement company, San Francisco, Cal., has been incorporated.

An explosion in the plant of the Coldwater Cement company, Coldwater, Mich., caused damage amounting to $4,000.

The Hillsdale Fire Brick and Clay company, Chicago, Ill., has been incorporated by E. W. S. Van Gilder, Walter E. McCormack and W. R. Burleigh.

The erection of a plant for manufacturing building and paving brick, tile and sewer pipe is contemplated at Quincy, Mich.

Hetherington & Berner have closed a contract with the R. F. Conway company of Chicago for a four-kettle railway asphalt plant.

W. C. Schmidt, New Bremen, O., has purchased an interest in the Illinois Portland Cement Paving company, 1238 Sixty-first-st., Chicago.

The company which owns the cement factory at Union City, Mich., has purchased extensive marl beds in the vicinity of Elk Rapids, Antrim county, Michigan, and will build a cement plant.

very extensive formation or argillaceous limestone that is found to exist in two grades, one carrying about 80 per cent. of calcium carbonate and the other about 72 per cent.

The Saginaw Clay Mfg. company, Saginaw, Mich., has closed down to add more machinery and make repairs to its plant. The company has refused all orders for paving brick since July 1.

A consolidation of the brick interests of Montgomery county, Kansas, has been effected and will be known as the Coffeyville Vitrified Brick and Tile company. A plant will be operated at Independence, Cherryvale and Coffeyville.

The Des Moines Brick Manufacturing company, Des Moines, Ia., elected officers at its annual meeting as follows: President and manager, H. D. Smith; vice-president, Martin Flynn; treasurer, S. A. Robertson; secretary, George B. Smith.

J. W. Horney, formerly of the Collinwood Shale Brick company, has organized the Cleveland Car company, which will build cars, cable tramways, conveyors, making a specialty of dryer and dump cars for brick and cement works.

The asphalt lands near Harned, Breckinridge county, Kentucky, belonging to George W., E. L. and J. W. Smith, have been leased to Jesse A. Young of St. Louis, Mo. The tract of land contains 160 acres. The development of the beds will begin Oct. 1.

The Maryland Cement company, Baltimore, Md., will double the capacity of its mill at Sparrow's Point, making its daily output 1,000 barrels of cement. Contracts will soon be let for the erection of three new buildings for the manufacture of cement; estimated cost, including machinery, $30,000.

The February term of the circuit court contained three suits against the city of Menominie, Mich., involving $50,000. J. C. Larson sued for $40,000 alleged to be due on a sewer contract; W. C. Campbell for $5,000 on a paving contract; the Menominie Water company, $5,000 water rental.

The plant of the Royal Fire Clay company at Midvale, O., has been purchased by John F. Townsend and others of Akron, O., for $84,000. This, together with the Robison Bros. company and the Crown Fire Clay company, gives Mr. Townsend twice the capacity in the manufacture of sewer pipe of any other concern in the world.

Considerable activity in the cement mills in the East, particularly in Pennsylvania, is reported. In addition to the dozen mills now running in Lehigh county three large mills are being built. As a result of this activity the cement imports have been cut down about 30 per cent. and this reduction will probably be still greater during the next year.

F. L. Smidth & Co., engineers, 66 Maiden Lane, New York City, report an order for the installation of grinding machinery and supplying its ball mills and tube mills for the Empire Portland Cement company, at Warners, N. Y. The company also has an order from the Georgian Bay Portland Cement Works at Owen Sount, Ont., Canada, for grinding machinery consisting of its ball mills and tube mills.

The Galesburg Paving Brick company, Galesburg, Ill., elected officers at its annual meeting as follows: President, J. B. Jensen; vice-president and general manager, James Bloomfield; secretary and treasurer, W. E. Terry; directors, J. B. Jensen, James Bloomfield, W. E. Terry, E. P. Ripley, George Chambers, W. K. Wolcott and T. R. Willard. The company will erect six new kilns in the place of the present big continuous kiln.

A lighting machine has been invented by Daniel Ogden at Columbus, Ind., which generates its own gas from carbite, and only generates sufficient to supply the lights desired. The machine which Mr. Ogden exhibits has a capacity of 15 lights, 26 candle power, but if only one light is desired only sufficient gas is generated to supply the same. The gas can be supplied at a cost of 13½ cents per 100 feet, and a 26 candle power burner will consume only one-half foot an hour.

Hetherington & Berner have closed contracts for railway asphalt plants with the Whitmore, Rauber & Vicinus company of Rochester, who have ordered a three-kettle plant for working Trinidad asphalt, and also have contracted with the Columbia Construction company of New York for a new four-kettle railway plant of large capacity. This is the second Hetherington railway plant bought by that company. The Hetherington & Berner company have brought out a new style, all steel, fire-proof construction stationary plant, which they claim is the finest plant of the permanent type ever built.

A stock company, with a capital of $150,000, is being formed by R. H. Hardiman to mine the asphalt beds found recently in

Rowan county, Kentucky, near the city of Morehead. Mr. Hardiman, who has associated himself with capitalists from Cincinnati and Pittsburg, has secured an option on 1,458 acres of land upon which the asphalt is located. It is probable that refineries will be erected at Lexington. Samples of the asphalt have been analyzed and tested and pronounced first class.

R. F. Sampson, the owner of an asphalt mine in Montague county, Texas, contemplates putting in a crusher and molding the asphalt into bricks. Mr. Sampson's mine is in a vein of asphalt which runs through a mountain and is one to five feet thick. The asphalt becomes richer and more oily as the mining reaches a greater depth. The people in Montague county had known of the deposit for some time, but they called it "oil rock."

LEGAL DECISIONS AFFECTING MUNICIPALITIES.

[Reported Specially for MUNICIPAL ENGINEERING.]

Rights of City in Letting Contracts for Improvements—Where contracts for public improvements are required to be let to the lowest bidder, a municipality may divide such improvement into several parts and let the different parts to different bidders, if the whole improvement may thus be completed at less cost than by a single bidder. Jones vs. City of Seattle (Wash.), 53 Pac. Rep. 1105.

Limitation of Municipal Taxation of Privileges—Where the law empowers a city to levy privilege taxes it confers the power to only tax such privileges as have been previously taxed by the legislature, or such as may afterward be ordered to be taxed by that body. Intn. Trading Stamp Co. vs. Memphis (Tenn.), 47 S. W. Rep., 136.

When Courts Cannot Control Municipal Authorities—Courts have no power to determine what municipal expenditures within the charter are necessary. Such matters are within the sound discretion of the municipal authorities. Payments by a city for lights and water, under a charter making express provisions for such expenses, and also payments on account of street improvements are legitimate municipal expenditures. White vs. City of Decatur (Ala.) 20 So. Rep. 999.

Delay Does Not Prevent Objection to Improvements—One who had the contract for making an extensive city improvement, with notice that the validity of the appropriation for the payment of such improvement was questionable, did some work for the purpose of inviting litigation. No action being brought, he entered actively upon the construction of the work, and had been so engaged for a month, when an action was brought in behalf of the tax-payers. The court held that such right on their part was not affected by delay, as the doctrine of laches rarely applies to the public. Engstad vs. Dinnie (N. D.) 76 N. W. Rep. 292.

Sewer Assessments in Connecticut—In making assessments for repairing and maintaining sewers in Connecticut the value of the potential use of a sewer to adjoining property-owners may be considered, though they have no buildings on their lands or no buildings which they have found necessary to supply with drains. Appeal of Hunter (Conn.), 41 Atl. Rep. 577.

When Average Cost Cannot be Assessed—Where the cost of making sidewalks in some blocks of a city is twice as much as that of making such improvements in other blocks, it is improper to assess the cost against abutting property at an average price per yard for the entire length of the street. Barker vs. So. Constr. Co. (Ky.), 47 S. W. Rep. 608.

Liability of Cities in Ohio—It is not necessary in order to recover for injuries received by reason of an unguarded excavation to show that the city had knowledge that it was being allowed to remain in an unguarded and dangerous condition, as it was bound to see that it was properly guarded. Gable vs. Toledo (Ohio), 90 Dec. 73.

Liability of City for Injuries from Electric Wires—A municipality in Pennsylvania is bound to exercise carefur supervision of electric wires over its streets, and is liable for injuries resulting from neglect of such duties, notwithstanding also the liability of the owner of such wires. Mooney vs. Luzerne, 9 Pulp's Rep. 230.

City Not Liable for Loss by Fire—A city is not liable for loss of property by reason of the negligence or inefficiency of its fire department, though a tax is specially levied to support such department, the duty to extinguish fires being a public and not a corporate one. Irvine vs. Chattanooga (Tenn.), 47 S. W. Rep. 419.

City Not Liable for Unlawful Arrests—A city is not liable for an unlawful arrest and imprisonment by its police officers, since such officers, being appointed by the city to perform a public service, are not such agents or servants as render the city liable for their acts. Kelley vs. Cook (R. I.), 41 Atl. Rep. 571.

When Not Liable for Wrongful Act of Officials—A municipal corporation is not liable for the wrongful acts of its officers or agents when the act is wholly ultra vires in the sense that it is not within the power or authority of the corporation to act in reference to the matter under any circumstances. Boyce vs. City of Albert Lea (Minn.), 76 N. W. Rep. 1131.

Recitals in Municipal Bonds—It may be laid down as a general rule that when municipal bonds recite facts which, if true, show that they were issued upon the conditions and for the purpose authorized by law, a bona fide purchaser, without notice of any irregularity therein, may safely rely upon such recitals. Wate vs. Santa Cruz (U. S. Cir. Ct.), 69 Fed. Rep. 619.

Damages for Not Carrying Out Contract for Sidewalks—The measure of damages where a sidewalk contractor is prevented by a city from carrying out his contract is the difference between the contract price and what it would have actually cost him to have constructed the sidewalks in question. Toledo vs. Libbie, 8 Ohio Dec., 589.

SELECTIONS FROM THE PRESS.

Smoke Prevention in Cities.

The day of the "smoke consumer" is past. Five years ago every city outside of the anthracite coal districts had a periodic spasm on the smoke question and much was heard of devices that were alleged to be efficacious in consuming smoke. The nuisance and the problem of its abatement are still with us, but the science of the latter has advanced so that instead of smoke consumption, which is a misnomer because the thing is impossible as a practical operation, we hear of smokeless combustion.

Although considerable progress has been made in securing a more perfectly smokeless combustion, the condition of the atmosphere in our cities where bituminous coal is used has not improved, but has rather become more intolerable. In every city a few steam-users are found who take some pride in their smokeless stacks, and in a few cities the nuisance in the business portion has been slightly reduced. But on the whole we believe that the atmosphere has steadily become more soot-laden and generally bad.

The smoke question is today therefore one of public sentiment and tolerance rather than a mechanical question. Legislation is impotent to cure the evil of smoking chimneys. After a crusade, when public opinion has been aroused and agitation has been rife, ordinances are passed and some show of enforcement made. But the people soon forget their civic duty and matters drift into the old channel. The reaction is often worse for the cleanliness of a city than if there had been no agitation, for the discharge of a few persons arrested for violating the city smoke laws, on technicalities or by reason of the courts deciding against the validity of such enactments, discourages the city officials and the leaders of the atmospheric purity organizations. In our opinion it will be many years before the smoke abuse will be done away with in the cities now using soft coal.

But there is no wno question that it is the duty of the community to prevent steam-users from polluting the atmosphere with smoke. The enormous loss to cities from bituminous coal smoke, especially western manufacturing cities, is beginning to be realized. In a number of those in which the abuse is the worst, the destruction of value due to coal smoke and the additional expense entailed by it in many ways are estimated as equivalent to the direct tax levy. No figures of even approximate accuracy can be made, but we believe that this estimate is not too high. The number of persons who directly profit by a practice that brings so great damage upon the entire community is not large. Perhaps in Pittsburg or Cleveland 1,000 chimneys maintain a nuisance to the annoyance of nearly four hundred thousand people. But these considerations are not sufficient to effect a reform.

In the days of the "smoke consumer" there was an obligation resting on the advocates of stringent legislation along these lines that gave them much trouble and proved a drawback to their work. That was the necessity of showing the emission of dense smoke from a stack is not necessary. But now the proposition can be unhesitatingly advanced that the prevention of heavy smoke is possible, practical and not expensive. Smokeless combustion is attained, and instead of being a heavy tax on these steam-users who maintain such ideal furnaces, it is more frequently a saving than an extra expense. The cost of construction or the installation of a special furnace for smokeless combustion is an expense that may sometimes be considerable, but such improvements should, and generally do, pay for themselves in a reasonable time and return a large profit on the investment. It is the economy of this sort of combustion that is having the greatest influence with steam-users. The hope of improvement lies in that direction, for neither moral considerations nor respect of the law has made any appreciable change for the better.

Another consideration strengthens this opinion. There is no government worthy of the name in the majority of our cities. Public sentiment in support of an ordinance must be overwhelming in order to secure enforcement with any sort of uniformity. In New York and several other eastern cities cleanliness is a religion, and western cities must embrace the faith before they obtain salvation.

The conditions for smokeless combustion are very simple. Ample grate area and flameway, the admission of sufficient air and in the proper manner, etc., to secure a thorough mixture with the gases of combustion and at the right temperature, even, careful stoking and regular, skillful attention to the fire. In large plants mechanical stokers are used to the best advantage, but in smaller plants just as good results have been obtained by hand stoking. The mechanical stoker is likely to do its work with more uniformity and for that reason is the most reliable even in small plants. But it must have proper attention.

A good furnace and an intelligent fireman being the necessary factors for smokelessness, there seems to be no reason why we should have so many smoking chimneys. The furnaces installed in any western city in a year show, however, that no attention is given to their design and that very few are large enough. The chief difficulty with firemen is that they have too much to attend to besides the care of the fire. Then they are not given strict orders not to allow the emission of a dense cloud of smoke from the chimney.—From The Engineer.

Hardening Cement Paving.

Portland cement paving will attain a considerable degree of hardness without any dressing or any special treatment; but paving laid in damp weather will ultimately attain a greater degree of hardness than that laid in very hot weather. Further hardening of the surface may be produced by keeping the work moist by means of wet cloths, or by damped sawdust or sand laid over the paving as soon as it has set; flooding the work with water, where possible, will be best of all. Miller mentions that cement work may be rendered tough and hard by gauging the material with 10 to 15 per cent. of minion—the siftings of iron stone after calcination. Indurating concrete slabs causes them to become very hard; by it their density is increased and porosity lessened.—British Brickbuilder.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

St. Joseph, Mo.—The question of passing a wide tire ordinance is being considered. City Engineer Rackliffe will correspond with various cities in which the wide tire ordinance is enforced, preparatory to framing a law.

Dallas, Tex.—A block of asphalt paving is being laid on Akard-st., opposite the city hall, by R. F. Sampson, the owner of an asphalt mine in Montague county, who has given the city a car load of asphalt in order to test its qualities.

San Pedro, Cal.—The city trustees of this city will appeal to the legislature to remedy certain defects which appear in the present system of street grades. The use of the bench marks of the geological survey in some cases, and other elevations in others, have resulted in confusion.

Des Moines, Ia.—An opinion was handed down Feb. 17 by Judge Bishop of the district court, in which he holds that the Des Moines Street Railway company is compelled under the statute to pay for the paving between its rails and one foot outside thereof. The decision affects many miles of paving in the city, part of which has already been assessed.

Chicago, Ill.—The effect of the continued cold weather upon the underground work of this city threatens to destroy much street paving in the down-town district. A personal inspection of the streets Feb. 10 by Commissioner McGann led him to express the opinion that the business section will practically have to be repaved in the spring. The damage was caused by the cold weather, making it necessary to repair the gas and water pipes and electric wires, and the companies leaving the pavement in bad condition.

CONTEMPLATED WORK.

Peru, Ind.—Brick paving has been decided upon for Broadway.

Utica, N. Y.—Resolutions have been passed to pave several streets.

Vancouver, B. C.—Georgia street, west of Granville, is in need of paving.

Rockford, Ill.—Plans are being prepared for macadamizing 6 mls. of streets.

Greenville, Pa.—Paving and sewers are contemplated at a cost of $10,000.

Meriden, Conn.—About $20,000 will be expended for paving during next summer.

Bradford, Pa.—Paving is contemplated for Elm street, from Congress street to South ave.

Norfolk, Va.—A resolution has been adopted authorizing the paving of Chapel street.

Gloversville, N. Y.—About 15,000 sq. yds. of brick paving is contemplated. C. Fiske, Jr., engr.

Butte, Mont.—Portions of Granite, Broadway, Park and three other streets will be paved.

Bethlehem, Pa.—About 60,000 sq. yds. of macadam paving will be constructed by day labor.

Quincy, Ill.—Ordinances were passed Feb. 6 providing for 29 blocks of brick street paving.

Fresno, Cal.—The trustees have been petitioned to pave K-st., between Fresno and Merced-sts.

Neponset, Ill.—The village trustees have decided to place 6 miles of gravel on Commercial-st.

Mattoon, Ill.—Contracts will be let in the spring for building sidewalks. A. C. Loomis, cy. engr.

Jonesboro, Tenn.—The issue of $100,000 bonds for the construction of 60 miles of road is proposed.

McKees Rocks, Pa.—An ordinance has been passed providing for paving Bell-ave.; estimated cost $8,000.

Minneapolis, Minn.—Bids will be asked for paving several streets with brick on 6-in. concrete base.

Fairfield, Ia.—A petition has been presented to the city council asking that S. Main-st. be paved.

Palatine, Ill.—The question of putting in stone crossings is being considered by the village council.

Lawrence, Mass.—The paving of Lowell-st. is recommended by Supt. M. Collins in his annual report.

Waukesha, Wis.—Brick paving is contemplated for portions of Madison, Broadway, South and Clinton-sts.

Webster Groves, Mo.—The board of aldermen authorized, Feb. 6, the macadamizing of Sylvester and Swan-aves.

Boonville, Mo.—A declaratory resolution was passed Feb. 6 to pave Main-st. Jasper McC. Daniel, cy. clk.

Rockledge, Pa.—The question of issuing bonds for macadamizing the streets of this town is being considered.

Chatham, Mass.—The proposed construction of a mile of crushed stone road on Main-st. has been favorably voted on.

Columbus, Ga.—An ordinance has been passed to improve the sidewalks throughout this city. L. H. Chappell, mayor.

Boston, Mass.—An appropriation of $20,000 has been requested for resurfacing Grove, Phillips and Garden sts.

Geneva, O.—The question of paving the principal business streets with brick is being agitated. Mayor Palmer.

Nantucket, Mass.—The town council has appropriated $3,000 for extending Orange st., and $1,000 for repaving Union st.

Kewanee, Ill.—The board of local improvement has been petitioned to pave the business section of this city.

Paterson, N. J.—An ordinance has been passed by the board of aldermen to pave about 60,000 or 70,000 sq. yds. this year.

Bath-on-Hudson, N. Y.—Petitions are being circulated to have an act passed by the Legislature for paving the streets.

Anderson, Ind.—The property owners on Ninth-st. have petitioned for brick paving for that street. H. H. Rogers, cy. engr.

Canton, O.—The construction of 15,000 sq. yds. of brick paving is contemplated. Louis N. Ley, cy. clk.

San Francisco, Cal.—The question of repaving Polk-st., from Sutter to Jackson, with bitumen or wood, is being discussed.

Potwin, Kas.—Street paving is contemplated for Greenwood and Woodlawn-aves.

Bridgeport, N. J.—Plans for a macadam or shell road through this place have been authorized. Wm. M. Carter, Woodbury, engr.

La Salle, Ill.—The board of local improvements has passed favorably upon petitions asking for 27 blocks of brick paving.

Oshkosh, Wis.—H. W. Leach, cy. engr., recommends granite block or brick pavement on streets having a large amount of traffic.

Springfield, Ill.—Paving is contemplated for Monumental-ave., from the present limit of the street paving to the cemetery gates.

Orrville, O.—Plans and specifications will be prepared by Cyrus Markly, C. E., Wooster, O., for about one mile of paving on Main-st.

Fayetteville, Ark.—The contract for macadamizing College-ave. was not let owing to the fact that no satisfactory bid was received.

Minneapolis, Minn.—The city clerk has been directed to ask for bids for paving several streets with brick on 6 ins. of concrete.

Boston, Mass.—The commissioners of the Metropolitan board contemplate the construction of a road from Boyleston to West Boylston.

Boone, Ia.—Plans have been completed for 9,039 sq. yds. of paving and 2,684 ft. of cement curbing at a cost of $17,000. Cy. Engr. Finley.

Champaign, Ill.—A petition is being circulated asking for a 40-ft. asphalt pavement on W. University-ave., from Neil-st. to Prospect-ave.

Buffalo, N. Y.—The paving of Tonawanda-st. with asphalt is proposed by the property-owners and North Buffalo Business Men's Association.

Spokane, Wash.—Plans, specifications and estimates have been submitted for paving nine streets. The total estimated cost is $246,968.90.

Plainfield, N. J.—Permanent paving is contemplated for Somerset-st., from Green Brook to Manning-ave., by the North Plainfield borough council.

Revere, Mass.—The Metropolitan park commissioners have completed plans for the proposed new boulevard through Revere to Chelsea and Everett.

Cleveland, O.—An ordinance has been passed to pave Meyer-ave., from Scranton-ave. to Pearl-st., with brick. Howard H. Burgess, cy. clk.

Southbridge, Mass.—A petition to have plans prepared for a new highway, between this town and West Dudley, has been presented to the selectmen.

Marquette, Mich.—The council has passed a preliminary resolution providing for macadamizing and curbing Craig-st., between Division and Altamont.

Birmingham, Ala.—Belgian block, brick or asphaltum paving is recommended for sections of several streets in the annual report of Mayor F. V. Evans.

Detroit, Mich.—President Beamer of the common council has declared himself against cedar block pavement and in favor of asphalt, brick and granite blocks.

Cleveland, O.—The board of control has been authorized to prepare plans for curbing and brick paving on Auburn-st., Starkweather-ave. and other streets.

Baltimore, Md.—The ordinance appropriating $21,0000 to repave Light-st., from Pratt to Lee with Belgian blocks, passed to its third reading in the first branch Feb. 6.

Rochester, N. Y.—The common council has been petitioned to adopt an ordinance for paving Monroe-ave., from Washington park to S. Goodman-st., with asphalt.

Milwaukee, Wis.—A determined effort will be made to secure legislation to provide for the completion of the Sheridan drive between this city and Chicago.

San Francisco, Cal.—A resolution of intention has been passed to pave the roadway of the crossing of Fillmore and Page-sts. with bituminous rock. M. F. Fragley, supt. sts.

Colorado Springs, Col.—The advisability of constructing a road from Victor to Elkton, Anaconda and Cripple Creek is being considered by County Commissioners Doran and Sinton.

Breese, Ill.—The village council has decided to purchase 10,000 ft. of Bedford stone, which will be used for building sidewalks on the principal streets; estimated cost $1,400.

Newport, Ky.—The council has authorized the paving of one block with brick and the macadamizing of 18 blocks, with combined concrete curb and gutters. W. L. Glazier, cy. engr.

Terre Haute, Ind.—The street committee has decided to pave Sycamore-st. east of Ninth. The city engineer has been ordered to prepare plans for concrete sidewalks on Fourth-st.

Warren, O.—The paving of High-st. is urged by the residents. Estimates have been submitted for asphalt block on concrete, broken stone and crushed stone foundations.

Hicksville, O.—Mayor Griffin and Councilman Kinmont have visited a number of cities to obtain information relating to brick paving. The principal business street of this city needs paving.

Crown Point, Ind.—Special elections will be ordered in Ross, Center, Cedar Creek and St. John townships, in March, to determine whether or not 30 miles of gravel roads shall be constructed.

Florence, Ala.—The legislature has passed a law authorizing this city to pave and otherwise improve the streets and sidewalks. Mayor Weakley desires information as to the cost of stone curbing.

Fort Wayne, Ind.—The property owners on Dawson-st., from Calhoun to Hoagland-ave., have petitioned for sheet asphalt paving; petitions have also been received asking for cement walks on Pontiac and Lafayette-sts.

Petersburg, Va.—The specifications for vitrified brick and sheet asphalt paving have been completed by Samuel M. Gray, C. E., Providence, R. I., and will be considered by the council March 1. Thos. R. Dunn, engr.

Battle Creek, Mich.—A resolution has been adopted directing the street and bridge committee to investigate upon the comparative cost of brick and asphalt, and upon the advisability of laying asphalt on Washington-st.

Dayton, O.—Resolutions were approved Feb. 17 for paving with stone flagging, cement or asphalt, the sidewalks on Broadway, from Dakota to Wolf creek; grading, graveling and paving the alley north of River-st., from Williams to Middle.

Grand Rapids, Mich.—Estimates have been prepared for paving Canal-st. with brick and asphalt; E. Fulton-st., from Jefferson-ave. to Union-st., with asphalt, with Medina stone blocks in the steep portions of the street.

Waterford, N. Y.—A bill has been introduced in the legislature to appoint Chas. A. Stewart, J. C. McGrievy, Jay Gilbert, Russell Lee, H. W. Vedder and Thos. O'Connor

a board of commissioners for the proposed Broad-st. paving.

Sioux City, Ia.—The question of paving certain streets and the material to be used is being discussed. Improvements will probably be made soon in the way of constructing brick, stone and cement sidewalks in the down-town districts.

New York City—The plan of President Coogan of the borough of Manhattan to curb and repave Elm-st., from Centre to Great Jones-st., with asphalt, has been approved by the board of public improvements. The matter has been pending since May 8, 1898.

Philadelphia, Pa.—Plans have been prepared for the boulevard to run from Broad and Wood-sts. to Fairmount Park, entering the park at Green-st. entrance. The proposed width of this boulevard is 275 feet, and the cost about $2,000,000.

La Crosse, Wis.—The special committee on paving unanimously recommends brick paving for the principal business strets and macadam for the residence streets. It also recommends that three experimental blocks of brick paving be laid this summer. Mayor McCord.

Philadelphia, Pa.—Bids will be asked for laying asphalt bicycle strips on each side of Broad-st., from Cumberland to Somerset-st.; repaving Broad-st. with asphalt on each side of the bridge crossing the Reading subway; spreading broken stone on country roads.

Lafayette, Ind.—The city council has decided to pave with sheet or block asphalt portions of South, Columbia, Ferry, Sixth and Union-sts. and Perrin-ave., and with brick, South, from Fourth to Fifth. The construction of a number of cement sidewalks is contemplated.

Normal, Ill.—Estimates were received Feb. 2 for asphalt and brick paving for various routes between this city and Bloomington. A canvas of the different routes shows a preference among the property-owners for brick paving. Prest. Gaston of Normal Imp. Assn.

Sioux City, Ia.—The city council will consider resolutions March 7 for paving with brick and curbing the following streets: Third-st., from Virginia to Wall; Jones, Jennings, Virginia, Court and Iowa, from Third to Fourth; Jackson, from Third to a point 314 ft. south.

St. Paul, Minn.—The city engineer has been directed to furnish revised estimates of the proposed boulevard along the bluff in West-st. park, from Delos-st. to the high bridge. Resolutions have been passed to pave Eagle-st., from Exchange to Third, with granite or sandstone.

Bay City, Mich.—Paving is contemplated for Water-st., from Third to Sixth; Tenth, from Water to Lincoln; First, from Washington-ave. to Sherman; Jackson, from First to Center-ave. Brick has been suggested, but the material will be decided upon in the spring. Cy. Engr. Turner.

Syracuse, N. Y.—The common council declared resolutions of intention Feb. 6 of paving with asphalt, asphaltina or vitrified brick portions of N. Clinton, Madison, Salina and Canal-sts. and Belden and Leavenworth-aves.; McBride-st., from James to Canal, with be paved with asphalt, asphaltina or brick, and from Canal to the Erie canal with sandstone blocks.

St. Louis, Mo.—Bills have been passed providing for paving as follows: Novaculite—Oregon-ave., from Cherokee to Utah; Flad-ave., from Tower Grove to Grand; Hickory, from Ohio to California; La Salle, from Jefferson to Ewing; Twentieth, from Madison to N. Market. Brick—Page-ave., from Pendleton to Taylor. Telford—Louisiana-ave., from Magnolia to Shenandoah.

Indianapolis, Ind.—Resolutions were adopted Feb. 7 for the following: Asphalt paving—Bellefontaine, Masachusetts-ave. to Nineteenth; Pennsylvania, Washington to Ohio; Seventeenth, Central to College, including cement walks; Noble, L. E. & W. tracks to Michigan; Shelby-st., Pleasant run to Martha-ave.; Market, Senate to West; Delaware, St. Clair to Sixteenth. Brick—Two alleys. Cement sidewalks in Nelson, from Woodlawn to Prospect, and brick walks in Sixtenth, from Hillside to Columbia.

CONTRACTS TO BE LET.

Joplin, Mo.—Bids are asked until March 7 for asphalt paving. S. J. McKee, cy. engr.

Bedford, Ind.—Bids are asked until March 5 for constructing portions of ten roads. John M. Gainey, co. audt.

Cleveland, O.—Sealed proposals will be received until March 4 and 7 for paving sundry streets with brick. George R. Warden, dir. pub. wks.

Lebanon, Ind.—Bids will be received March 15 for paving W. Pearl-st. with brick. The bids received Feb. 13 were rejected. H. S. Freeman, cy. engr.

Benton Harbor, Mich.—Bids will be received until March 20 for paving Pipestone-st., from Pleasant-st. to Britain-ave., with asphalt. Cy. Clk.

Woodbury, N. J.—Bids will be received until March 11 for building a gravel road 6 miles long and a macadam road 4,204 ft. long. Wm. C. Carter, engr.

Kokomo, Ind.—Bids will be received until March 13 for the construction of 12,000 sq. yds. of brick paving and 6,000 lin. ft. of curbing. Chas. R. Ford, cy. clk.

Woodbury, N. J.—Bids are asked until March 11 for macadamizing about 4,204 ft. of Broad-st. and for 6 miles of gravel road. C. W. Starr, dir. bd. chosen freeholders.

Washington, D. C.—Sealed proposals will be received until March 4 for paving B-st., N. W., from Ninth to Twelfth, with vitrified blocks. John B. Wight, pres. dist. comrs.

Brooklyn, N. Y.—Bids are asked until March 7 for macadamizing portions of Park-place-ave., Ocean-ave. and Eighty-fourth-st. Jas. P. Keating, comr. highways.

Chicago, Ill.—Sealed proposals will be received until March 1 for asphalt, granite block, cedar block paving and macadamizing on a large number of streets. L. E. McGann, prest. bd. local imp.

Cleveland, O.—Sealed proposals will be received until March 4 for paving Clark, Logan, Richland and White-aves., and Halsey, Linden and Scott-sts. with brick. Bids will be received March 14 for Medina block paving on Perkins-ave. George R. Wheeler, dir. pub. wks.

Albany, N. Y.—Bids will be received until March 6 for the improvement of the East-ave. road, from the easterly line of the village of Brighton easterly to the Fairport and Pittsford fork in the towns of Brighton and Pittsford, Monroe county. Edward A. Bond, state engineer and surveyor.

Georgetown, O.—(Special).—Contracts will

be let March 14 for improving sections 1, 2 and 3 of the Redoak and Straight Creek road in Jefferson twp. and March 15 for improving sections 1, 2, 3, 4, 5, 6 and 7 of the Shinkle Ridge and Cedron road in Lewis twp. H. L. Jennings, co. audt. Charles M. Gordon, co. engr. and surveyor.

CONTRACTS AWAYDND.

St. Augustine, Fla.—The contract for paving St. George-st. with brick has been awarded to McGuire & McDonald.

Philadelphia, Pa.—The contract for repairing paved streets was awarded Feb. 16 to Michael O'Rourke for $234,500.

Vevay, Ind.—The contract for constructing free gravel roads has been awarded to J. D. Froman of this city for $31,300.

Decatur, Ind.—The contract for constructing the E. Washington macadam road was awarded Feb. 16 to E. Woods & Co. for $15,975.

New York City.—Thomas F. Tuohy & Co. has been awarded the contract for laying flag sidewalks in the Third ward of W. Queens Borough for $49,000.

Bloomfield, N. J.—The contract for paving Broad-st. with telford was awarded Feb. 6 to Francis J. Marley for $15,465 and Bay-ave. to Francisco Bros. for $3,075.

Kokomo, Ind.—The contract for constructing 2,500 sq. yds. of brick paving was awarded to the Capitol Paving company of Indianapolis for $17,670:

Toledo, O.—Paving contracts were awarded Feb. 16 as follows: Monroe-st., Contractor Jennyson, $13,315.43; Milburn-ave., George H. Bodette, $9,223.26.

Rochester, N. Y.—Whitmore, Rauber & Vicinus have secured contracts as follows: Bartlett-st., asphalt, $1.70 or $7,263; Alexander-st., macadam, $5,150.

Eau Claire, Wis.—A. R. Rutledge of Rockford, Ill., secured the contract for vitrified brick paving in this city at $1.30 a sq. yd. or $13,400.

Kansas City, Mo.—The contract for grading the western extension of Independence boulevard, from Woodland-ave. to Highland-ave., was awarded to the Boyd Paving Co. and 17.7 cts. a cubic foot.

Toronto, Ont.—Paving contracts have been awarded as follows: Paving and Construction Co., asphalt, $3,095; brick, $2,666; J. McBean, brick, $7,344; J. F. Connolly, brick, $3,787; J. H. McKnight, macadam, $2,898.

Albany, N. Y.—Brick paving contracts were awarded Feb. 6 as follows: T. Henry Dumary, Dove-st., $1.75 a sq. yd., or $3.952; Hamilton-st., $1.70, or $15,005; Mulderry Bros., Elizabeth-st., $1.65, or $14,462.

New York City—Bids were received Feb. 14 for completing the abandoned contract for regulating, grading, setting curb stones, flagging sidewalks and laying crosswalks in Webster-ave., from Mosholu Parkway to the city line of Bronx as follows: P. J. Duffy, $89,868; Edw. J. Farrell, $106,538.

Newark, N. J.—Bids were received Feb. 20 for constructing stone heads to subways No. 1 and 2, under the driveway in Branch Brook park, the lowest bidder being Norcross Bros., of New York City. Their bid was $15,187 for Indiana limestone. The awarding of the contract was deferred a week.

Denver, Colo.—Only one bid was received for the repair during 1899 of streets and alleys paved with asphalt, and that was from the Colorado Paving Co. It was as follows: 2½-in. asphalt weaing surface, $1.90 a sq. yd.; 2-in. wearing surface, $1.65; 6-in. Portland cement, $1.20 a sq. yd.; 4-in. concrete, 95 cts.

Atchison, Kas.—The contract for repaving S. Fourth-ave. with vitrified brick on old concrete foundation was awarded, Feb. 6, to the Atchison Paving Brick Co., as follows: Paving, 16,555 sq. yds., 70 cts.; cement curb, 6x7x20-ins., 232 lin. ft., 48½ cts.; cement curb 5x6x20-ins., 492 lin. ft., 45½ cts.; curb reset, 490 ft., 10 cts.; cast iron bridge plates, 5,200 lbs., 1¾ cts.; brick sidewalk, 1,600 sq. ft., 5½ cts.; tile relaid, 150 lin. ft., 30 cts.; cedar blocks renewed, 2,752 cu. yds., 1 ct.; total, $12,253.

Winnipeg, Man.—The bids received Oct. 19, 1898, for asphalt paving were made public Jan. 30, when it was decided to have the work done by day labor. The bids were as follows: Warren-Scharf Paving Co., New York City, asphalt paving, 16,800 sq. yds., $2.73¼ ry. track, brk. or Scoria blk., 1,230 sq. yds., $2.31; natural stone curb, 2,960 ft., $1.28; to radius of 6 ft., 180 lin. ft., $1.50; total, $52,806. Kelly Bros & Co., Winnipeg, asphalt paving, $2.71½ ry. track, $2.25; curb, $1.30 and $1.50; total, $52,498. Estimate of H. N. Ruttan, city engineer, paving, $2.21; ry. track, $2.27; curb, $1.20 and $1.30; total, $43,806.

Fulton, N. Y.—(Special.)—O. C. Breed, cy. engr., says the contract for 2,200 sq. yds. of brick paving on Second-st. was awarded Feb. 23 to John Hendricks, Oswego, N. Y., as follows: Excavation, 25 cts. a cu. yd.; embankment, 35 cts. a cu. yd.; brick, $1.88 a sq. yd.; stone curbing, 55 cts. a lin. ft.; cobblestone pavement, 60 cts. a sq. yd.; 4 sewer manholes, $30 each; 9 sewer inlets, $8 each; 10-in. pipe sewer, 27 cts.; 15-in., 39 cts.; 18-inch., 47 cts.; cast iron pipe, $26 per ton; grading six street intersections, $12.50 lump sum; putting broken stone surface in place, $1 per cu. yd.; total, $8,986.60.

Anderson, Ind.—Bids were received Feb. 20 on paving. There were nine bids on brick, two on asphalt block and two on creosoted blocks. The lowest bids on these materials were: Brick, 67½ cets. a sq. yd.; asphalt block, $1.49; creosoted blocks, $1.69. The bids on the different streets, including excavation, foundation curbing, sidewalk, etc., were: Jackson-st.—Brick, $3.10; asphalt block, $4.10; creosoted blocks, $4.50. Ninth-st.—Brick, $3.35; asp. blk., $4.50; creo. blk., $4.50. Tenth and Twelfth-sts., west of Jackson—Brick, $2.80; asp blk, $3.70; creo. blk., $4.60. Tenth and Twelfth-sts., Meridian to Jackson—Brick, $3.40; asp. blk., $4.55; creo. blk., $5. The council deferred the awarding of contracts until Feb. 27.

Sandusky, O.—(Special.)—A. W. Miller, cy. clk., says bids were received Feb. 15 for 27,301 sq. yds. of paving, 10,251 lin. ft. new curb and resetting 2,989 ft. old curb. The bids were as follows: Asphalt—Ayres Asphalt Paving company, Zanesville, 2-in. wearing surface, California asphalt, $1.50, or $44,458.10; 1½-in surface, 1-in. binder, $1.53 or $45.277.13; new curbing, 31 cts.; resetting, 11 cts. Warren-Scharf Asphalt Paving company, New York City, 2-in. Trin. lake asphalt, $1.65 or $48,728.38; 1½-in., 1-in. binder, $1.70 or $50,093.33; new curb, 33 cts.; resetting, 10 cts. F. E. Cole, Toledo, 2-in. Trin. land asphalt, $1.82 or $54,091.33; new curb, 38 cts.; resetting, 17 cts. Alcatraz Asphalt company, Detroit—2-in., $2.45 or $71,231.18; 1½-in. 1-in. binder, $2.20 or $64,405.93; new curb, 38 cts.; resetting, 15 cts. Newcastle asphalt block on 4-in.

concrete, A. G. O'Donnell, Sandusky—$1.89 or $55,075.60; curb, 31 and 10 cts. Geo. J. Doerzbach, Sandusky—$1.89⅓ or $56,062.08; curb, 39 and 11 cts. C. F. Hartman, Sandusky—$1.91 or $55,976.09; curb, 33 and 15 cts. M. J. Callan, Sandusky—$1.93 or $56,944.99; curb, 38 and 12 cts.

SEWERS.

Indianapolis ,Ind.—A bill passed by the senate Feb. 24 gives city councils the authority to build sewers anywhere regardless of objections of property-owners. The land can be appropriated and used, and no objections can be legally enforced.

Brantford, Ont.—A proposed amendment to by-law 433, relating to the construction of private sewers, sets forth a plan to reduce the cost of making private connections with public sewers, the applicant to pay 17 cents for each foot for 4-in. pipe and 22 cents for 6-in. pipe.

Washington, D. C.—An adverse report by Gen. Ludlow regarding the contract of Michael Dady of New York City, for building a sewerage system in Havana, Cuba, will in all probability result in the contract being canceled by the colonial board. The contract was entered into with the Spanish authorities and involves several millions of dollars.

Waterbury, Conn.—A decision has been filed by Judge Shumway of the superior court which, if sustained by the supreme court of appeals, will necessitate the expenditure of several thousand dollars by this city. The suit, which has been pending for eight years, is for $25,000 damages for polluting the Naugatuck river and to secure a permanent injunction enjoining the city from emptying sewage into the stream.

Syracuse, N. Y.—A plan will be laid before the board of health by O. A. Thomas, health officer, providing for the construction of ventilating chimneys for the main branches of the sewerage system. The purpose of the plan is to avoid the dangers incident to the collection of sewer gas. The city sewage comes principally from east of the creek, while prevailing winds are from the west and northwest. These winds enter the mouths of the sewers, driving back the gas.

Faribault, Minn.—(Special.)—The sewer tunnel which has been under construction in this city for the last few months is about completed. The work has been in charge of Wm. C. Fraser of Rochester, Minn. The total length of the sewer is 10,826 ft., and consists of the following: 3,680 ft. 15-in. pipe, 2,166 ft. tunnel, 895 ft. 12-in. pipe, 620 ft. 10-in. pipe, 2,778 ft. 9-in. pipe, 687 ft. 8-in. pipe. The tunnel is 6 ft. high and 30 ins. wide and extends through a clear sand rock from end to end. The sewer pipe laid in the tunnel is 12 ins. in diameter. The tunnel is built under the bluff, and leading into the main tunnel from the foot of the bluff are six air chambers between Third and Fourth-sts., whose total length is nearly 500 ft. These chambers were begun as soon as work was commenced at the ends of the tunnel, and when they reached the main line of the sewer the men began drifting in opposite directions. But so accurate were the measurements of Mr. Fraser that when the men met, working in opposite directions, the different sections of the tunnel bores met exactly. O'Neil & Son had the contract.

CONTEMPLATED WORK.

St. Cloud, Minn.—Plans for new sewers have been prepared.

Chambersburg, Pa.—The question of building sewers is being agitated.

Howell, Mich.—The construction of a sewerage system is contemplated.

Waseca, Minn.—Bids will be asked in April for building a sewerage system.

Ottumwa, Ia.—Specifications are being prepared for a number of sewers.

Chester, Pa.—Bids will be asked soon for building sewers in W. Sixth-st.

Wakefield, Mass.—The construction of a sewage disposal system is contemplated.

Carlisle, Pa.—The question of building a sewerage system is being agitated.

Spokane, Wash.—The construction of sewers, at a cost of $15,000, is contemplated.

Elgin, Ill.—The construction of a sewerage system is again contemplated.

Charleston, S. C.—Plans are being prepared for a sewerage and water works system.

Carrollton, Mo.—This city is agitating the question of building a sewerage system.

Westport, Mo.—The construction of a main sewer, with an outlet, is contemplated.

Boston, Mass.—The aldermen have appropriated $1,000,000 for building certain sewers.

La Crosse, Wis.—The question of building sewers, at a cost of $30,000, is being considered.

Meriden, Conn.—The common council has ordered sewers constructed in ten streets during 1899.

Bridgeport, Conn.—The committee on sewers has asked for an appropriation of $42,840.50.

Napoleon, O.—The construction of the proposed trunk line sewer will probably begin this spring.

Memphis, Tenn.—About $90,000 will be expended for sewer work this spring. A. T. Bell, cy. engr.

Niagara Falls, N. Y.—The construction of sewers, at an estimated cost of $44,776, has been recommended.

Martinsville, Ind.—The question of building several miles of sewers this spring is being discussed.

Warsaw, Ind.—The question of building a sewerage system, which is badly needed, is being discussed.

Newark, N. J.—The construction of a brick sewer in Morris-ave. is contemplated at a a cost of $22,200.

Bloomington, Ill.—The council is reported as being in favor of the double ring sewer from the valley.

Medford, Ore.—The construction of 4,000 to 5,000 ft. of 16-10-8-in. pipe sewers is contemplated.

Tunkshannock, Pa.—Bids will be asked soon for completing the sewerage system; estimated cost, $6,250.

Auburn, Ind.—The citizens have petitioned the city council for a sewerage system; estimated cost, $50,000.

Sherman, Tex.—Specifications for a new sewerage system have been completed. Judge R. R. Hazlewood interested.

Minneapolis, Minn.—The council committee on sewers will ask the council to expend $23,000 for sewers this year.

Hagerstown, Md.—Mayor Schindel has been authorized to secure estimates for constructing a sewerage system.

Augusta, Ga.—The construction of a com-

plete sewerage system is recommended by Dr. Eugene Foster, prest. bd. of health.

Roswell, N. Mex.—This city contemplates building sewerage and water works systems and desires estimates on the cost of same.

Coldwater, Mich.—Riggs & Sherman, Toledo, O., have been retained again this year by this city for sewerage and paving work.

Quincy, Ill.—Objections to the building of the Cedar-st. storm sewer will be heard March 6; estimated cost, $8,400.

Winchester, Va.—Action will soon be taken by the council toward building the proposed sewerage system; estimated cost, $20,000.

Oakland, Cal.—An ordinance has been passed appropriating $50,000 for building a storm sewer in Cemetery creek canyon.

New Bremen, O.—The construction of the Walnut-st. sewer, which will consist of 4,122 ft. of 24 and 20-in. pipe, is contemplated.

Greenville, Pa.—An ordinance has been passed ordering the completion of the sewerage system; estimated cost, $60,000.

Atchison, Kas.—Fred Giddings, cy. engr., has been directed to prepare estimates for building the South Atchison sewerage system.

Columbus, Ga.—The construction of an 8-in. sewer on Thirteenth-st. is recommended. B. F. Wilson, chrmn. com. on sts. and sewers.

Watsonville, Cal.—The specifications of V. T. McCray, engr., for a sewerage system have been adopted; estimated cost, $40,000.

Schenectady, N. Y.—The bill authorizing the common council to borrow $135,000 for the construction of sewers has passed the assembly.

Cedar Rapids, Ia.—(Special.)—G. H. Merridith, cy. engr., says he is preparing plans for a new sewerage system for the southwest district.

Watertown, N. Y.—Mayor Wise favors an amendment to the charter providing for the construction of main sewers to cost about $112,000.

Mattoon, Ill.—The construction of a complete sewerage system and one and one-half miles of sewers is contemplated. A. C. Loomis, cy. engr.

Havana, Ill.—An ordinance has been passed providing for the construction of a section of the sewerage system. Bernhard Wolters, cy. clk.

St. Cloud, Minn.—The board of public works is considering plans for the construction of one-half mile of sewers. J. A. McDonald, mayor.

Wilkesbarre, Pa.—An ordinance has passed first reading appropriating $60,000 for about 3 miles of brick and pipe sewers. W. V. Ingham, cy, engr.

Conneaut, O.—Plans and specifications for the construction of main sewers, sub-sewers and branch sewers have been filed. J. L. Risley, vil. clk.

Cohoes, N. Y.—Plans have been completed for sewers in section 2. A sewer is proposed for Columbia-st. at a cost of $5,000, Edward Hayes, cy. engr.

Jamaica, (L. I.) N. Y.—Plans for the proposed sewage disposal beds for the sewerage system have been completed. M. J. Golden, deputy com'r. of sewers.

Wilkesbarre, Pa.—An ordinance will be introduced in the council asking that the city's indebtedness be increased so as to provide $60,000 for sewers.

Estherville, Ia.—The construction of sewers at a cost of $3,500 is contemplated. M. L. Archer, chrmn. com. Boynton & Warriner, engrs., Cedar Rapids.

Grand Island, Neb.—Plans and specifications have been prepared and bids will soon be asked for 1,376 ft. of 8-in. sewer extension. Arnold C. Koenig, cy. engr.

San Diego, Cal.—Plans have been completed for about 42 miles of pipe sewers for the district north of N-st.; estimated cost, $108,229. Cy. Engr. Capps.

Greenville, N. J.—The construction of a trunk sewer to drain the section bounded by the boulevard, Fulton-ave., Danforth-ave. and Newark bay, is contemplated.

Los Angeles, Cal.—The construction of sewers on Tenth and Eleventh-sts., from Crocker to San Pedro and Crocker, from Ninth to Eleventh, was recommended Feb. 20.

Danbury, Conn.—About 4,200 feet of 10-in. pipe sewer will be bu... this summer at a cost of $4,000. It is thou... tha. no contract will be let. A. L. Davis, cy. engr.

Tupper Lake, N. Y.—The Tupper Lake Water & Sewer company has been organized to build sewerage and water works systems and the work will probably be let by contract. J. L. Jacobs, prest.

Hartford, Conn.—Plans have been prepared for a storm water ditch, 2,000 ft. long, 3 ft. deep and 18 ft. wide at the top, to relieve the Franklin-ave. sewer. C. H. Bunce, cy. engr.

Cambridge, O.—Resolutions have been passed directing City Engineer Hoge to prepare plans for the extension of the outfall sewer, from Fourth to Ninth-sts., with laterals in 12 streets.

Springfield, Mass.—The proposed Mill River valley sewer will be built this spring. It will require about 2,360 cu. ft. of brick masonry and 600-ft. of underdrain. Chas. M. Slocum, cy. engr.

Winona, Minn.—City Engineer Heuston has suggested the building of a tunnel under the city, from the lake to the river, with an intercepting sewer along the lake. The plan is favored.

Tarboro, N. C.—The legislature has been asked to grant this town authority to vote on the question of issuing $50,000 sewer, water works and electric plant bonds. J. A. Weddell, clk and treas.

Springfield, Mass.—Plans and estimates for the proposed Mill River valley sewer, to drain Gunn-square and vicinity, have been recommended; estimated cost, $50,000. Chas. M. Slocum, cy. engr.

Long Island City, N. Y.—The estimated cost of rebuilding the Broadway sewer, which has caved in for a distance of 500 ft., is placed at $25,000 by Matthew J. Goldner, deputy comr. Sewers in Borough of Queens.

Gainesville, Fla.—A company has been organied by Jas. M. Graham, Dr. J. V. McKinsley, Jr., B. F. Hampton and C. W. Bartleson, which proposes to build a sewerage system under a franchise which will soon be asked for.

Philadelphia, Pa.—The board of surveyors approved plans Feb. 20 for main sewers in Cottman-st., from the Penn. R. R. to the Delaware river, and in Ripka, Pechin and Hermitage-sts., to connect with the Manayunk intercepting sewer.

Mt. Vernon, N. Y.—A bill has been introduced in the legislature authorizing the mayor of this city to, on the confirmation of the board of aldermen, appoint three commissioners who are to construct an outlet sewer which will be built through the town of Pelham to Long Island Sound and under the water to Machaux Rock.

CONTRACTS TO BE LET.

South Bend, Ind.—Bids will be received until March 13 for constructing an 18-in. pipe sewer in Paris-st. L. A. Hull, cy. clk.

Cincinnati, O.—Sealed proposals will be received until March 3 for building sewers, drains, etc. A. B. Ratterman, prest. B. C. A.

Norfolk, Va.—Sealed proposals will be received until March 9 for constructing sewers in the Brambleton ward. C. J. Jones, prest.

Cleveland, O.—Bids are asked until March 3 for building sewers in Clark and Franklin-aves. and Wilhelm-st. Geo. R. Warden, dir. pub. wks.

Meriden, Conn.—Bids are asked until March 2 for building 13,000 ft. of pipe sewers and 4,000 ft. of storm water sewers. W. S. Clark, cy. engr.

Winnipeg, Man.—Sealed tenders will be received until April 3 for furnishing two pumping engines of 5,000,000 gals. capacity each. C. J. Brown, cy. clk.

Cleveland, O.—Bids will be received until March 15 for building the fourth section of the Walworth-st. main sewer, consisting of 1,340 lin. ft. sewer 16-ft. 6-in. in diameter. Geo. R. Warden, dir. pub. wks.

Honolulu, H. I.—Bids are asked until April 15 for furnishing materials for sewer construction, pumping machinery, etc. Rudolph Hering, 100 William-st., New York; Jas. A. King, minister of the interior.

Niles, O.—Sealed proposals will be received until March 7 for building sewers, drains, catchbasins, manholes lampholes etc., in Robbins-ave., from Summit-st. to Musquito creek. W. Y. Sayers, clk. bd. sewer comrs.

Keshena, Wis.—Sealed proposals will be received until March 3 for building sewer and water systems at the Menomonee boarding school. D. H. George, U. S. Indian agent, Keshena; W. A. Jones, comr. Indian affairs, Washington, D. C.

Woonsocket, R. I.—Sealed proposals will be received until March 6 for constructing sec. 4 of the sewerage system, consisting of the following: 700 ft. 30-in. brick sewer; 1,030 ft. 24-in. pipe sewer; 300 ft. siphon under Blackstone river; 160 cu. yds. rubble masonry; 1,000 cu. yds. rock excavation. Frank E. Holden, chrmn. bd. sewer comrs.

Cleveland, O.—Bids will be received March 2 for building sewers in Blaine, Meridian and Home-sts. and Fairview-ave.; March 3, in Clark and Franklin-aves. and Wilhelm-st.; March 10, Benton and Congress-sts. and Franklin-ave.; March 16, Chatham, St. Clair and Tod-sts.; March 17, Boyne and Treas-sts. and W. Madison-ave. Geo. R. Warden, dir. pub. wks.

CONTRACTS AWARDED.

Elkhart, Ind.—The contract for building a sewer was awarded to Kinney & Swinehart, for $2,550.02.

Indianapolis, Ind.—The contract for building a sewer was awarded, Feb. 13, to J. C. Veney, at $1.62 per lin. ft.

Rochester, N. Y.—The contract for building the East-ave. sewer was awarded to Thomas F. Kearney for $20,947.

Lawrenceville, Ill.—A twenty-year franchise for a sewerage system has been granted the Bray Construction company of Belleville, Ill.

Clayton, N. Y.—The contract for the sewerage and water systems has been awarded to A. F. Norris of Philadelphia for $46,000.

Seattle, Wash.—The contract for constructing the Republican-st. sewer was awarded to Erickson & Roseleaf for $25,930.

Oakland, Cal.—The contract for repairing the Mill Creek sewer has been awarded to the Heman Construction company for $3,494.

Hartford, Conn.—P. H. Harrison & Son secured sewer contracts, Feb. 1, as follows: Buckingham-st., $4,788.50; Vine and Capen-sts., $6,305.50.

Ottawa, Ont.—The bid of Laverdure & Laflamme, $107,695, for building the third section of the sewerage system, has been recommended for acceptance.

Steelton, Pa.—The contract for furnishing thirteen miles of terra cotta sewer pipe was awarded, Feb. 8, to Arthur M. Pearson & Co. of New York City for $9,529.

Mexico, Mex.—The contract for furnishing sewer pipe for the sewerage system for this city has been awarded to the San Antonio Sewer Pipe and Manufacturing company for $600,000 exclusive of freight.

Niagara Falls, N. Y.—Bids were submitted, Feb. 10, for constructing sewers in several streets, as follows: D. Phillips & Co., nine streets, $17,800; W. W. Reed & Co., eight streets, $11,000; W. H. Cookman, seven streets, $11,200; C. Crogan, three streets, $5,060.

Denver, Col.—The contract for building the Capitol Hill storm sewer was awarded, Feb. 15, to the John M. O'Rourke Construction company. This contract was awarded to J. J. Fleetford, but he did not succeed in obtaining the necessary $50,000 bond, and it was awarded to the above company as the next lowest bidder.

WATER-WORKS.

Utica, N. Y.—A bill providing for municipal ownership of the city's water supply will be sent to the legislature.

Toronto, Ont., Canada.—Alderman Hanlon has proposed the establishment of a purification system at a cost of about $1,200,000.

O'Fallon, Ill.—The question of municipal ownership of the water and light of the O'Fallon Electric Light and Water company is being agitated.

Hintonburg, Canada.—In the case of the Suburban Water Works company vs. Hintonburg, to recover $20,000 damages for the cancelation of a contract to construct water works in this village, judgment was given in favor of the municipality.

Warren, O.—The city council has begun injunction and equitable relief proceedings against the Trumbull county commissioners on the ground that the county infirmary contaminates the water of the Mahoning river, the source of the city's water supply for domestic and other purposes.

Churubusco, Ind.—The citizens of this town voted, some time ago, for a water and electric light plant, and the town board issued

bonds for its erection. The plant was built and mortgaged for $14,500 to secure payment. Injunction proceedings were instituted in the meantime by citizens on the ground that, with the last bond issue the 2 per cent. limit upon the taxable value of property in the town was exceeded. The injunction has been sustained by Judge Adair, who lets the plant revert to the contractors.

Memphis, Tenn.—The suggestion of Mayor Williams, in his message, regarding the controversy between the city council and the Artesian Water company, has been adopted by the city council. His suggestion provides for the following: The present contract to remain in force; the company to extend its mains to annexed territory as required; the city to pay for all hydrants and flush tanks put in after this date at the same rate as that now provided by the contract; the company to refund to the city in reduction of its water rent all incomes above 6 per cent.

CONTEMPLATED WORK.

North Chicago, Ill.—A committee has been appointed to secure a public water system.

Portland, Ore.—The pumping capacity of the water works will be enlarged.

Rochester, N. H.—The question of improving the water supply is being considered.

Hillsboro, Ore.—Bids are desired at once for building gravity works. H. V. Gates.

Alameda, Cal.—Municipal ownership of the water works plant is proposed by Dr. W. Blunt.

Scio, O.—A franchise for a water works will probably be granted soon. John Shaffer, mayor.

Port Austin, Mich.—This village will be bonded for $4,000 to build a water works system.

Geneva, N. Y.—The question of building a new 5,000,000 gal. reservoir is being considered.

Austin, Minn.—Various plans for securing a permanent water supply are being considered by the council.

Bay City, Mich.—The question of securing a better water supply will probably be voted on. Mayor Lind.

Milford, Ind.—The question of building water works and electric lights at a cost of $25,000 is being considered.

Cedar Rapids, Ia.—Several new filters will be added to the water works plant this year. Chas. J. Fox, supt.

Lakeport, Cal.—The contract for a water works system will probably be let April 10. H. V. Keelny, town clk.

Danville, Ill.—The South Danville Electric Light & Power company contemplate erecting a water plant for that village.

Fairhaven, Wash.—Bids will be asked in March for extending the water mains. Fairhaven City Water & Power company.

Newburgh, N. Y.—The question of issuing $274,000 bonds for an increased water supply will be voted on March 14.

Jackson, Mich.—Plans are being considered for increasing the water supply from 7,000,000 gallons to 10,000,000 gallons a day.

Hartford, Mich.—The time for letting the contracts for the proposed water works has been postponed to about the last of March.

Albany, Ind.—The town council is receiving plans and specifications for building a new water works and electric light plant.

Newark, N. J.—The purchase of a site for a 600,000,000 gal. storage reservoir has been recommended by the water committee.

Orange, N. J.—Owing to a change in plans for the pumping station, dam, etc., at Campbell's Pond, bids will probably be readvertised.

Pendleton, Ore.—The council has under consideration a proposition to install a new pumping plant; also, for a gravity system to cost $60,000.

Manti, Utah.—The question of securing a better water supply is being considered. Christensen Bros., Gunnison, Utah, may be addressed.

Denton, Tex.—About 12,000 ft. of pipe and 16 new hydrants will be required by the Denton Water, Light and Power company. H. C. Storrie, gen. mgr.

Middletown, Pa.—The Middletown Water company contemplates putting in a new filter plant of about 6,000 gals. capacity. George Bellmeyer, prest.

Savannah, Ga.—Plans and specifications are being made for a water works system at Tybee Island, Ga. John L. Hayden, Q. M., Tybee Island.

San Francisco, Cal.—The Spring Valley Water company contemplates the construction of a filtration system on Alameda creek at a cost of $450,000.

Watsonville, Cal.—The estimated cost of a water works system is placed at $55,000 by V. T. McCray, engr., in his report to the trustees.

Alton, Ill.—Bids will probably be wanted for 27,350 ft. of 4-6-8-in. cast iron water pipe, 20 hydrants and 25 water gates. T. A. Taylor, supt.

Alexandria, Ind.—The purchase of an air compressor, capable of raising 400 gals. of water a minute, is contemplated for the water works. W. T. Baker, chrmn. com.

Bloomington, Ind.—Bids will be asked about March 1 for an impounding reservoir, filter basin, a new pump house, a 12-inch main to city, etc. J. D. Showers, prest.

Albany, Ind.—Plans and specifications for a combined water works and electric light plant are being prepared by Jas. B. Nelson, C. E., of Indianapolis. J. E. Hill, prest. bd.

The question of building water works will be voted on as follows: Barrett, Minn., March 10; Mountain Lake, Minn.; Morton, Minn.; St. Petersurg, Fla., March 7; Reidsville, N. C., March 15.

New York City.—The installation of a salt water pipe line system for fire protection in the congested wholesale district is provided for in a resolution which has been offered in the city council.

Youngstown, O.—An investigation is being made by F. Herbert Snow, C. E., Boston, Mass., with the assistance of City Engineer Lillie, preparatory to determining upon the most available source of water supply for this city.

Ballston, N. Y.—The question of securing a better water system is being discussed and Jas. E. Conner, Alijah Comstock and D. F. Winney have been appointed a committee to ask the board of trustees to submit to vote a proposition to bond the village for a gravity water system.

Muncy, Pa.—Plans are being prepared for a 2,000,000 gal. distributing reservoir, the laying of about 2 miles of 8-10-inch pipe and the

construction of an intake on Glade Run, above the present reservoir.

Ottumwa, Ia.—The report of the water committee recommends that the incoming council make a 2-mill levy to continue for 5 years and take the necessary steps for the construction of a water works plant. Mayor Phillips.

Washington, D. C.—An act is before congress which authorizes the architect of the capitol building to contract with a filter company for two filtration plants, one at each end of the building, of 350,000 gals. each.

Grand Rapids, Mich.—Plans and specifications were adopted Feb. 17 for laying mains in a number of streets and sealed proposals will be advertised. As a precaution against freezing the board of public works also decided to adopt specifications to lay the mains five and one-half feet deep.

Holyoke, Mass.—A report on the proposed new storage reservoir has been sumitted by Engineer Tighe. It involves the building of a 500-foot dam at Tatro Brook, and a 20-inch main to carry water from the reservoir to the Highlands; estimated cost, $77,000. John J. Sullivan, chrmn. comrs.

Baraboo, Wis.—Resolutions were passed Feb. 14 to serve notice upon the manager of the water works, calling h's attention to the old and inferior condition of the water works machinery. The mayor and water committee has been authorized to proceed at once to secure a sufficient amount of water for fire protection and private consumers, and if such supply cannot be secured steps will be taken to revoke the company's charter.

The construction of water works systems is contemplated at the following places: New Richland, Minn.; Sacred Heart, Minn.; Blooming Prairie, Minn.; Ellsworth, Wis.; Corydon, Ia.; Russellville, Ky.; Oconomowoc, Wis.; Barnesville, O.; Sheridan, Mont.; Jackson, O.; Allen, Neb.; Durand, Mich.; Forestport, N. Y.; Sanford, S. C.; Goldhill, Or.; Jerome, Ariz.; Heber City, Utah.; St. Mary's, Ont.; Osawatomie, Kas.; Locust Gap, Pa.; Bristow, Ia.; Red Lake Falls, Minn.

CONTRACTS TO BE LET.

Seattle, Wash.—New bids will be asked for building the Cedar river water works addition.

Allison, Ia.—Bids will be received until March 7 for constructing water works. W. F. Ray, mayor.

Jamesburg, N. J.—Bids are asked until March 6 for building a water works system. Frank Jennings, mayor.

Lakeport, Cal.—Bids are asked until April 11 for constructing the water works system. H. V. Keeling, town clk.

Everett, Mass.—Bids are wanted until March 7 for cast iron water pipe, specials, cocks, etc. Fred A. Beals, water registrar.

Fayetteville, Tenn.—Bids will be received until March 15 for building a gravity system of water works. B. A. Lewis, mayor; J. E. Poindexter, clk.

Hartford, Mich.—The letting of contracts for water works will be delayed until the last of March or first of April owing to some delay in securing a site for the pump house.

Fairhaven, Wash.—Bids will be asked in March for the proposed improvements and extensions to the water works system. T. W. Gillette, supt. Fairhaven City Water and Power company.

Washington, D. C.—Bids will be received until March 11 for building a reservoir in the District of Columbia and for furnishing cast iron water pipe. John B. Wight, prest. dist. comrs.

Keshena, Wis.—Sealed proposals will be received until March 3 for building water and sewer systems at the Menomonee boarding school. D. H. George, U. S. Indian Agt., Keshena; W. A. Jones, comr. Indian affairs, Washington, D. C.

Cleveland, O.—Sealed proposals will be received until March 16 for furnishing four new water cylinders and otherwise repairing and rebuilding Worthington pumping engine No. 4 at the Davis-st. pumping station. Geo. R. Warden, dir. pub. wks.

West Bay City, Mich.—Bids will probably be asked April 1 for furnishing for new water works the following: One 5,000,000-gal. pump, 4,000 ft. 48-in. riveted steel water pipe for intake, about 17,600 ft. of 30 to 6-in. pipe. J. H. Blomshield, cy. engr.

St. Louis, Mo.—Bids are asked until March 21 for furnishing and installing at high service pumping station No. 1 three vertical, triple expansion, crank and flywheel, condensing pumping engines, etc.; estimated cost, about $300,000. Robt. E. McMath, prest. B. P. I.

CONTRACTS AWARDED.

Oshawa, Ont., Canada.—The contract for building the water works system has been awarded to Clark & Connolly.

Alden, N. Y.—The contract for constructing the water works system has been awarded to M. A. Castoe, of Bellaire, O.

Goshen, Ind.—H. H. Hallett of Aurora, Ind., secured the contract for laying five miles of new water mains in this city.

Dubuque, Ia.—The contract for furnishing two 8,000,000 gal. pumping engine was awarded to the Holly Manufacturing company, Lockport, N. Y.

Worcester, Mass.—The contract for furnishing water gates was awarded, Feb. 16, to the Eddy Valve company, Waterford, N. Y., for $7,855.

Montreal, Que.—The contract for a new boiler for the upper level pumping station was awarded, Feb. 9, to John McDougall, city, for $5,975.

Wellsville, O.—William McCormick, secured the contract, Feb. 10, for 1,000 feet of twelve-inch cast iron pipe, at $16.90 per 2,000 lbs.

BRIDGES.

Joplin, Mo.—Bids will be readvertised for a bridge over Willow branch, on Sixth-st.

Floodwood, Minn.—A petition has been filed asking for a bridge across the Floodwood river.

Bradford, Pa.—The estimated cost of the proposed iron bridge at Barbour-st. is $4,362.

Gretna, La.—A bridge across the Seventeenth-st. canal at Lake-ave. has been proposed.

Marietta, O.—Plans and specifications have been prepared for the proposed Putnam-st. bridge.

Villagrove, Ill.—Bids are asked until March 4 for a highway bridge. Co. Comrs., E. G. Heilman, co. clk.

Madison, Neb.—Bids will be received until

March 7 for constructing bridges. E. G. Heilman, co. clk.

Painesville, O.—The construction of a steel truss drawbridge between this city and Fairport is proposed.

Janesville, Ia.—The construction of a bridge across the Cedar river is proposed; estimated cost, $10,000.

Toledo, O.—The construction of two bridges across Swan creek is contemplated, according to press reports.

Providence, R. I.—Bids will probably be asked in March for a new bridge at Mill-st.; estimated cost, $21,000.

Birmingham, O.—Plans are being prepared for a new bridge. J. C. Hausen, prest. co. comrs., Sandusky.

Fort Scott, Kas.—The construction of a bridge over Mill creek is contemplated, at a cost of about $3,500.

St. Louis, Mo.—The concrete bridge to Forest Park, a view of which appeared in the last issue of Municipal Engineering, was built by the Geisel Construction company, on plans designed by Park Commissioner Ridgely. It is a fine example of this kind of work. The estimate of its cost was $5,500, and it was feared that its construction would have to be abandoned because this amount would be inadequate, but the work was done at a price several hundred dollars less than the appropriation.

Lawrence, Mass.—The construction of a bridge across the Merrimac river is contemplated; estimated cost, $75,000.

New Kensington, Pa.—The construction of a bridge across the Allegheny river, between this place and Boquet, is contemplated.

Shreveport, La.—Bids are asked until March 9 for building a bridge over Cowhide bayou. A. L. Duringer, clk. of parish.

Reading, Pa.—An appropriation of $50,000 has been asked for to build a bridge over the Philadelphia & Reading tracks at Spring-st.

Rensselaer, N. Y.—A bill has been introduced in the legislature providing for a free bridge across the river between this city and Albany.

Morgantown, W. Va.—A bill has been passed in the house authorizing the construction of a bridge over the Monongahela river at this place.

Ottawa, Ill.—Plans for the proposed steel bridge across the Illinois river and over Covel creek will be prepared soon. Mayor Hook.

Macon, Ga.—The mayor has been authorized to advertise for plans and specifications for a two-span iron bridge across Ocumigee river at Fifth-st.

Torrington, Conn.—This town has voted to build a bridge across the Naugatuck river between this town and Harwinton; estimated cost, $10,000.

Somerville, O.—Plans for a high truss bridge to be constructed across Seven Mile creek have been prepared by L. H. Dillon, city engineer, Hamilton, O.

Buffalo, N. Y.—A resolution has been passed by the board of aldermen to construct a bridge over the creek on Sprenger-st. at an estimated cost of $6,000.

Cedar Rapids, Ia.—(Special.)—City Engineer Merridith has recommended that two new steel bridges be built, one at B-ave. and one at Third-ave.

Omaha, Neb.—Andrew Rosewater, cy. engr., has been directed to prepare plans for a viaduct crossing the railway tracks on S. Twenty-fourth-st.

Cleveland, O.—Bids are asked until March 10 for a bridge over the Cuyahoga river. G. W. Kittredge, ch. engr., C., C., C. & St. Paul ry., Cincinnati.

Chicago, Ill.—Bids are asked until April 10 for building a two-track railway bridge and a highway bridge over the Chicago river. Bd. Trustees sanitary dist.

Marietta, O.—The question of issuing $70,000 bonds for constructing a bridge across the Muskingum river will be voted on in April. E. F. Gates, cy. engr.

Detroit, Mich.—The question of issuing $600,000 bonds for constructing the proposed Belle Isle bridge will be submitted to vote, after which permission will be asked of the legislature.

Norwalk, O.—The question of bonding the city for $11,000 to build a steel viaduct to replace the present wooden high bridge, will probably be submitted to vote. John Laylin, cy. engr.

Grand Haven, Mich.—The construction of three bridges is contemplated at and near this city, as follows: One to connect Grand Haven with Spring lake; one at Eastmanville; one at the Bridge-st. ferry.

Macon, Ga.—Plans, specifications and proposals will be received March 14 for an overhead steel truss bridge over the Ocmulgee river with a vitrified brick floor resting on a concrete base. S. B. Price, mayor.

Bellefontaine, O.—Bids will be received until March 21 for building a single span Pratt truss bridge over the Miami river in Richland twp. J. K. Elder, Joel Easton, John Brown, comrs.; C. D. Campbell, audt.

Boston, Mass.—Plans are being prepared for a steel plate girder deck bridge at the Back Bay Fens entrance on Charles Gate, over new Ipswich-st. The bridge will be 83 ft. wide at one end, 104 ft. at the other, will have a buckle plate and asphalt floor and nine girders, seven of which will be 55 ft. 4 ins. long and two 58 ft. 6 ins. long. Cy. Engr. Jackson.

Des Moines, Ia.—A resolution has been adopted directing the engineer to prepare plans and specifications for two bridges over the Des Moines river, one to replace the present structure on N. Sixth-st., and the other at the intersection of Southeast Sixth-st. The engineer was instructed to draft two sets of plans for the N. Sixth-st. bridge, one for an ordinary steel structure and one for a bridge on the Milan plan.

PARKS.

Peoria, Ill.—The park at Prospect Hights will be improved this summer.

Evanston, Ill.—The extension of the park system is contemplated. C. L. Williams, comr. pub. wks.

Denver, Col.—The park commissioners will purchase land and expend about $29,000 for laying out new parks.

Pueblo, Col.—The park commissioners contemplate extending the southern boundary of Mineral Palace park to Fifteenth-st.

New York City.—Bids will be received until March 2 for preparing the ground for planting in Riverside park, dept. of parks.

Omaha, Neb.—The board of park commissioners has begun proceedings to condemn

land adjoining Riverview park, to be used for extending the present park.

Quincy, Mass.—A bill has been referred to the committee on Metropolitan affairs, which provides for an act to authorize the board of metropolitan park commissioners to construct roadways or boulevards from Squantum Head, in this city, to Boston and to the Blue Hills reservation.

STREET CLEANING.

Watertown, N. Y.—Bids will probably be asked for garbage collection.

Sacramento, Cal.—Action towards the erection of a garbage factory is urged.

Atlanta, Ga.—Bids are asked until March 3 for garbage disposal. Secy. bd. health.

Philadelphia, Pa.—Bids will be asked for sprinkling the macadam roads during the summer.

Kansas City, Mo.—The question of a better method of cleaning asphalt streets is being considered.

Hazleton, Pa.—The question of garbage disposal is recommended for consideration by the mayor in his annual message.

Los Angeles, Cal.—Two plans for garbage disposal have been submitted to the council, and bids will probably be asked on each plan.

Cincinnati, O.—Thomas J. and James Strack have asked the board of city affairs for the contract for the removal of garbage.

Jacksonville, Fla.—Propositions for the purchase of a street sweeper are being considered by the B. P. W., according to press reports.

Memphis, Tenn.—An appropriation of $60,000 has been allowed Dr. Jones, of the board of health, to build two additional crematories.

Madison, Ind.—Bids will be received until March 6 for the removal of all garbage and refuse matter for a year. Geo. C. Lewis, M. D., Secy.

Cleveland, O.—Bids are asked until March 7 for cleaning the paved streets and alleys from April 15 to December 15. Geo. R. Warden, dir. pub. wks.

Boston, Mass.—The new garbage plant, which is owned and operated by the New England Sanitary Product company, was badly damaged by fire Feb. 10.

Fall River, Mass.—Bids will be received until March 5 for collecting, removing and disposing of all kitchen waste, garbage, etc. Geo. S. B. Pritchard, clk. com.

Quincy, Ill.—A petition from the Women's council and chamber of commerce asking the council to make an appropriation to keep the streets and alleys clean has been granted.

Los Angeles, Cal.—Superintendent of street drains has devised an iron push cart, upon the platform of which can be placed a sheet-iron can, in which to collect street sweepings.

New York City.—Bids are asked until March 10 for reducing and disposing of street sweepings, ashes, garbage and household refuse in the boroughs of Queens and Richmond. Jas. McCartney, comr. st. cleaning, Manhattan borough.

Buffalo, N. Y.—The contract for sweeping the streets for 5 years has been awarded to Willis Y. Graves and Claud C. Jones of Indianapolis, Ind., at the following prices: Asphalt streets, 23½ cts. per 10,000 sq. ft.; granite and stone, 33½ cts. per 10,000 sq. ft. The contract calls for allowances aggregating $100,000 annually.

Brooklyn, N. Y.—The municipal assembly refused, Feb. 7, to authorize the issue of bonds for the purchase of a plant for the street cleaning department. The contract of Joseph A. McGary expires April 1, and under the charter the city is to undertake the work of cleaning the streets on the day his contract expires.

Louisville, Ky.—(Special.)—Thomas P. Craig, secretary B. P. W., says bids will be advertised for at an early date for the construction of a garbage incinerator capable of burning not less than 250 tons of garbage and waste per day. The board of public works desires to examine plans of the various garbage destructors.

STREET LIGHTING.

Wilmington, Del.—The question of building a lighting plant is being considered.

Wilkesbarre, Pa.—John H. Dando is securing information preparatory to building a municipal plant.

Centralia, Ill.—Bids are asked until March 7 for furnishing 53 or more arc lights for 5 years. M. E. Drum, chrmn. com.

Cambridge, O.—Bids are asked until March 6 for furnishing 75 arc lights for the streets for 5 years. T. R. Deselm, cy. clk.

New Rochelle, N. Y.—Bids are asked until March 6 for lighting the street with electricity or gas for one year; vil. bd. trustees.

Sea Isle City, N. J.—Bids are asked until March 2 for lighting the borough with arc, incandescent, Welsbach or acetylene. Jos. J. Chapman, clk.

Albany, Ind.—(Special.)—Plans for an electric lighting plant are being made by Jas. B. Nelson, C. E., of Indianapolis, Ind. J. E. Hill, prest. bd.

Elizabethtown, Ky.—Bids are asked until March 6 for the purchase of a 20-year franchise to construct and operate a lighting plant. R. L. Wintersmith, mayor.

Quincy, Mich.—Bids will be asked in March for the construction of a lighting plant, having a capacity for 50 1,200-c. p. arc. and 1,500 16-c. p. incandescent lights. Chas. F. Crouch, cy. engr.